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United States Patent [19]

Nolan

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[54] **APPARATUS FOR PRESENTING THE CONTENT OF AN INTERACTIVE ON-LINE NETWORK**

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[73] Assignee: **Microsoft Corporation**, Redmond, Wash.

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/503,131**

[22] Filed: **Jul. 17, 1995**

[51] **Int. Cl.**[6] **G06F 13/38**; G06F 15/17

[52] **U.S. Cl.** **395/200.48**; 395/200.33; 345/330

[58] **Field of Search** 395/200.1, 200.2, 395/200.03, 200.04, 200.11, 200.15, 330, 762, 200.5, 200.8, 200.31, 200.34, 200.54, 200.68, 200.49, 200.47, 200.33, 200.48; 345/330

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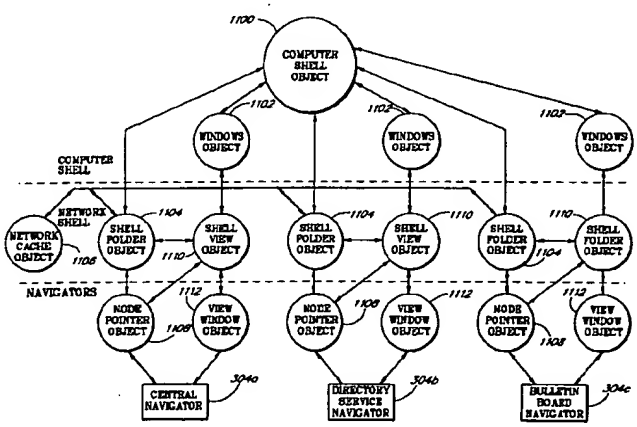
Attorney, Agent, or Firm—Leydig, Voit & Mayer, Ltd

[57] **ABSTRACT**

The on-line network access system of the present invention operates as an extension of a computer's operating system to provide a graphical interface which displays the offerings available in the on-line network. The organization of the offerings are displayed in a manner which is visually similar to the way the operating system displays the organization of the computer's local file system. Using multiple navigators, the system displays different user interfaces which correspond to different offerings on the on-line network. The system further provides a content map which illustrates the location of a user in the on-line network. In addition, the system creates "shortcuts" which allow users of the on-line network to reference particular locations in the on-line network. A unique shortcut data structure allows the storage of the shortcuts in the user's computer or the transfer of the shortcuts to others.

35 Claims, 25 Drawing Sheets



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5,617,570	4/1997	Russell et al. .	
5,619,632	4/1997	Lamping et al.	395/141
5,650,994	7/1997	Daley .	
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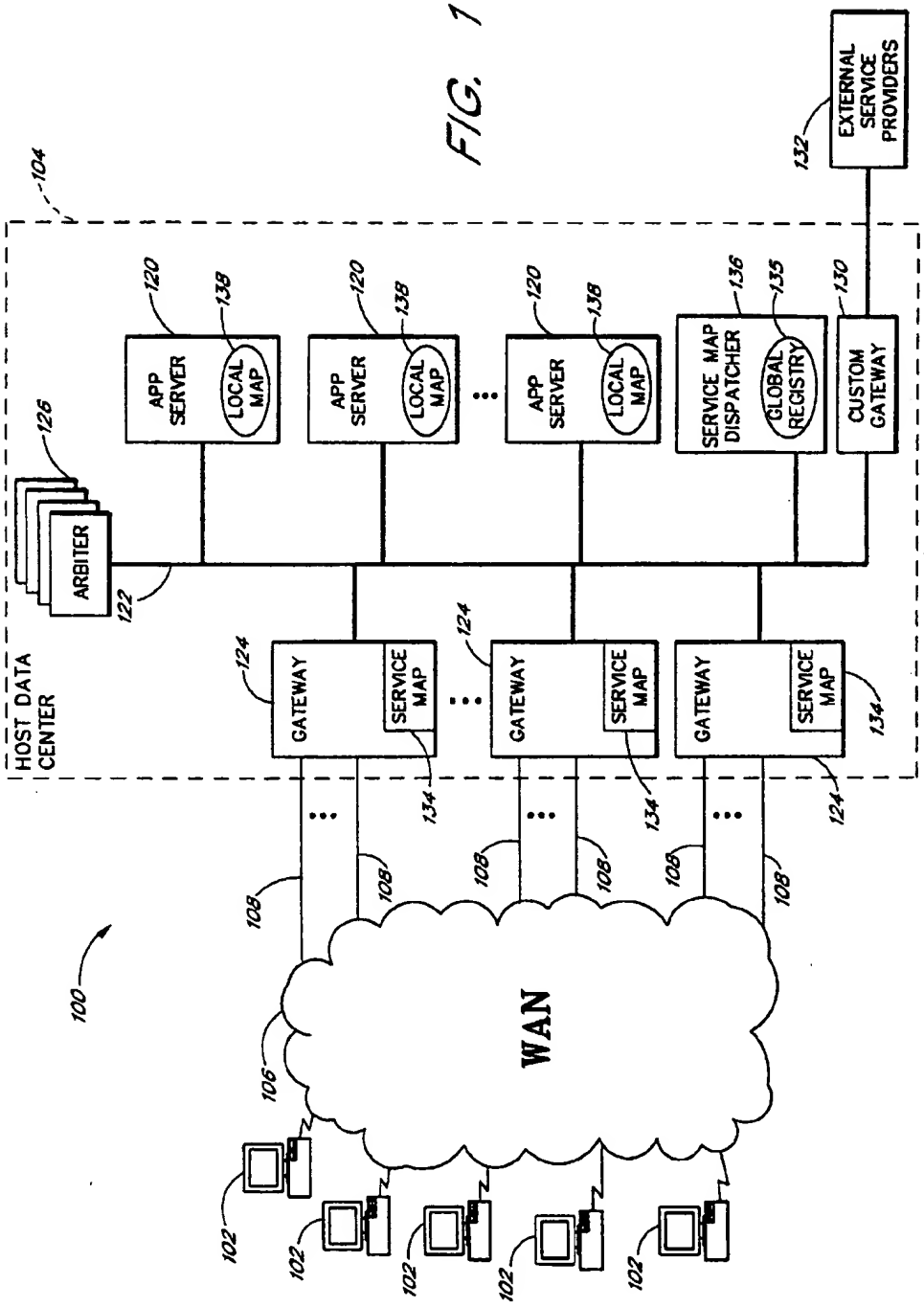
FIG. 1


EXTERNAL SERVICE PROVIDERS
132
104
HOST DATA CENTER
APP SERVER
LOCAL MAP
120
138
SERVICE MAP DISPATCHER
GLOBAL REGISTRY
136
135
CUSTOM GATEWAY
130
ARBITER
122
126
GATEWAY
SERVICE MAP
124
134
WAN
106
108
102
100

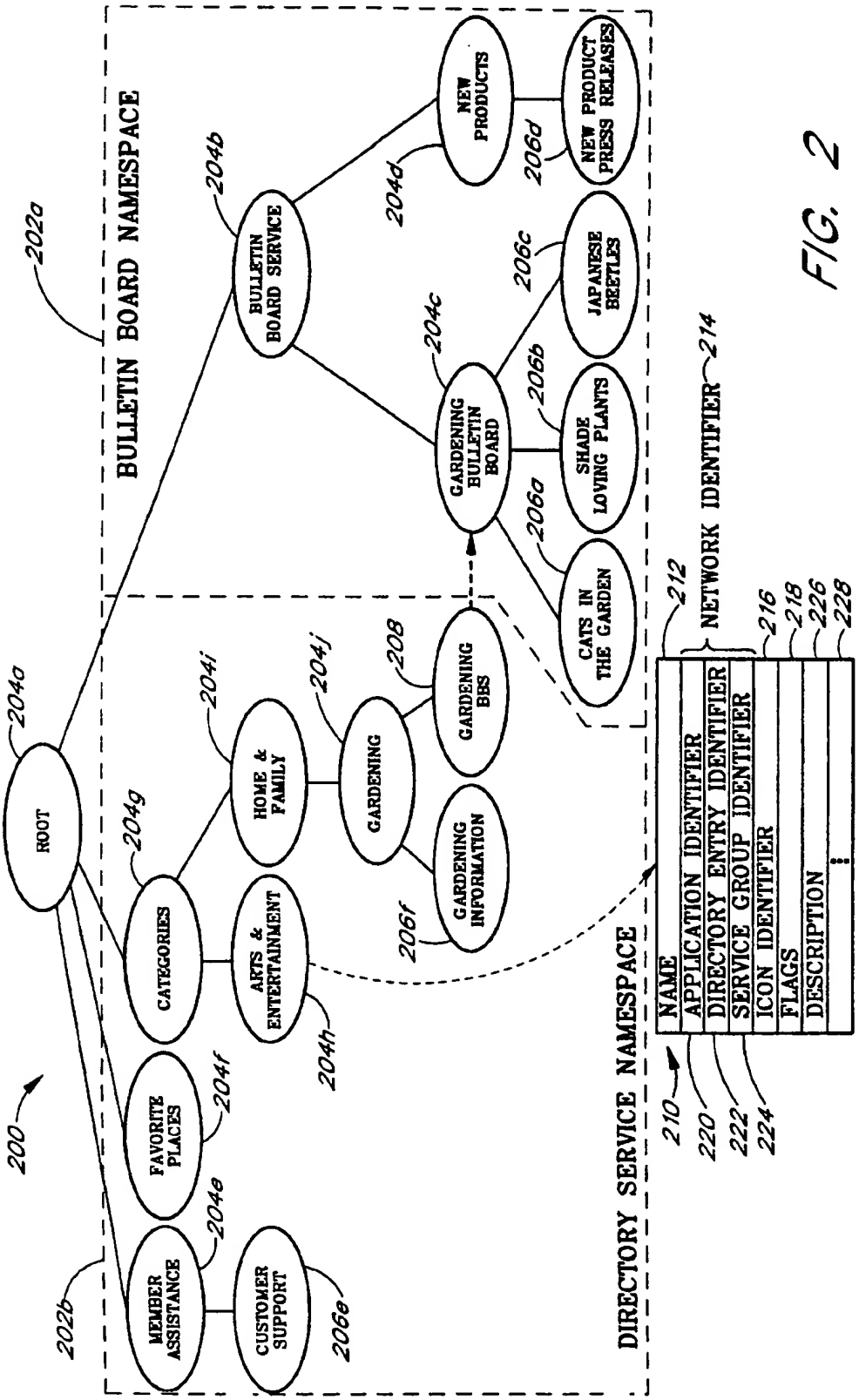


FIG. 2

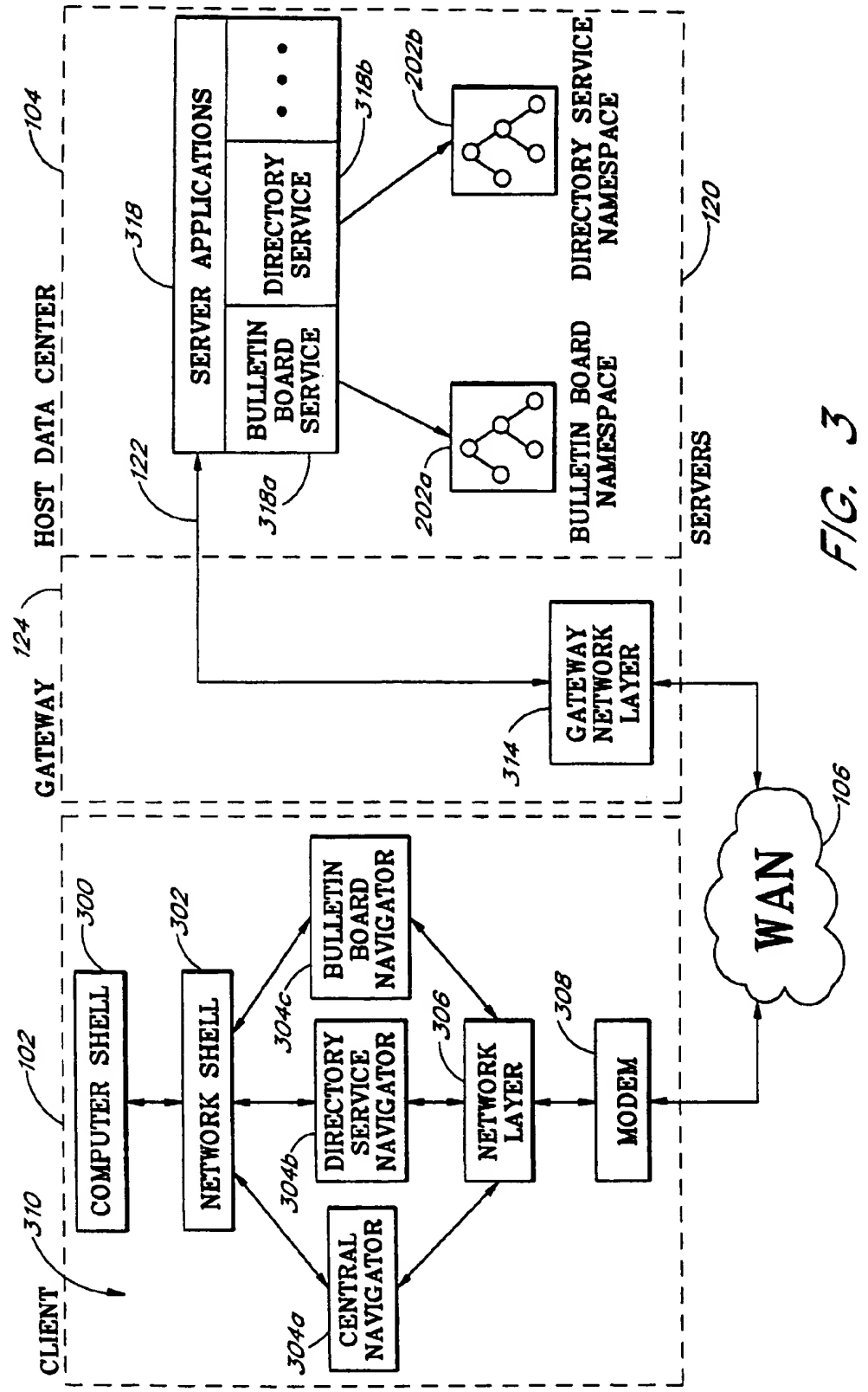

HOST DATA CENTER
104
SERVER APPLICATIONS
318
BULLETIN BOARD SERVICE
DIRECTORY SERVICE
• • •
318a
318b
122
202a
202b
BULLETIN BOARD NAMESPACE
DIRECTORY SERVICE NAMESPACE
SERVERS
120
GATEWAY
124
GATEWAY NETWORK LAYER
314
WAN
106
CLIENT
310
COMPUTER SHELL
300
NETWORK SHELL
302
BULLETIN BOARD NAVIGATOR
DIRECTORY SERVICE NAVIGATOR
CENTRAL NAVIGATOR
304a
304b
304c
NETWORK LAYER
306
MODEM
308
102

FIG. 3

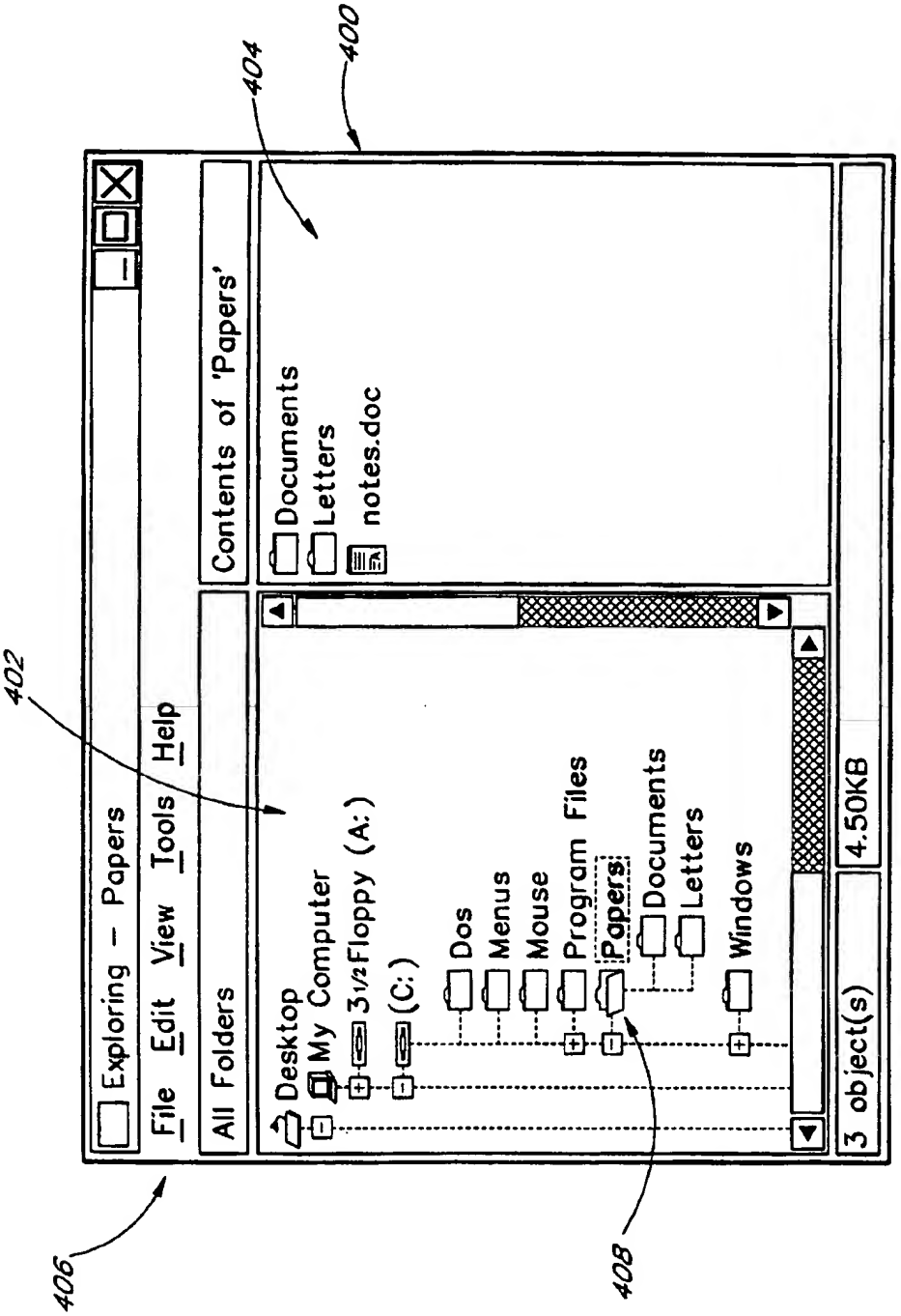

400
402
404
406
408
Exploring - Papers
File Edit View Tools Help
All Folders
Contents of 'Papers'
Documents
Letters
notes.doc
Desktop
My Computer
3½Floppy (A:)
(C:)
Dos
Menus
Mouse
Program Files
Papers
Documents
Letters
Windows
3 object(s)
4.50KB

FIG. 4

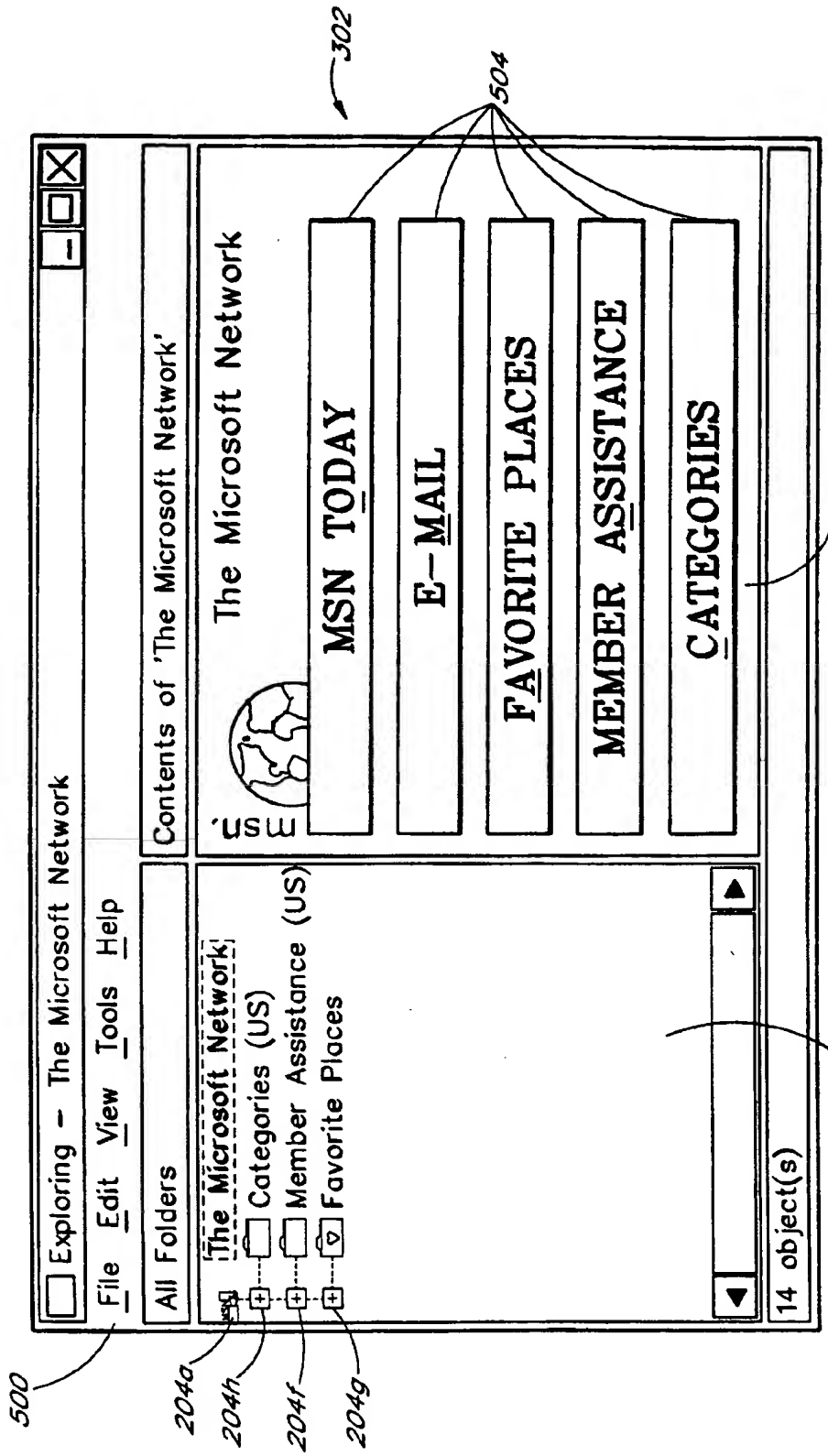

302
504
Exploring - The Microsoft Network
File Edit View Tools Help
All Folders
Contents of 'The Microsoft Network'
The Microsoft Network
MSN TODAY
E-MAIL
FAVORITE PLACES
MEMBER ASSISTANCE
CATEGORIES
404
The Microsoft Network
Categories (US)
Member Assistance (US)
Favorite Places
14 object(s)
402
500
204a
204h
204f
204g

FIG. 5

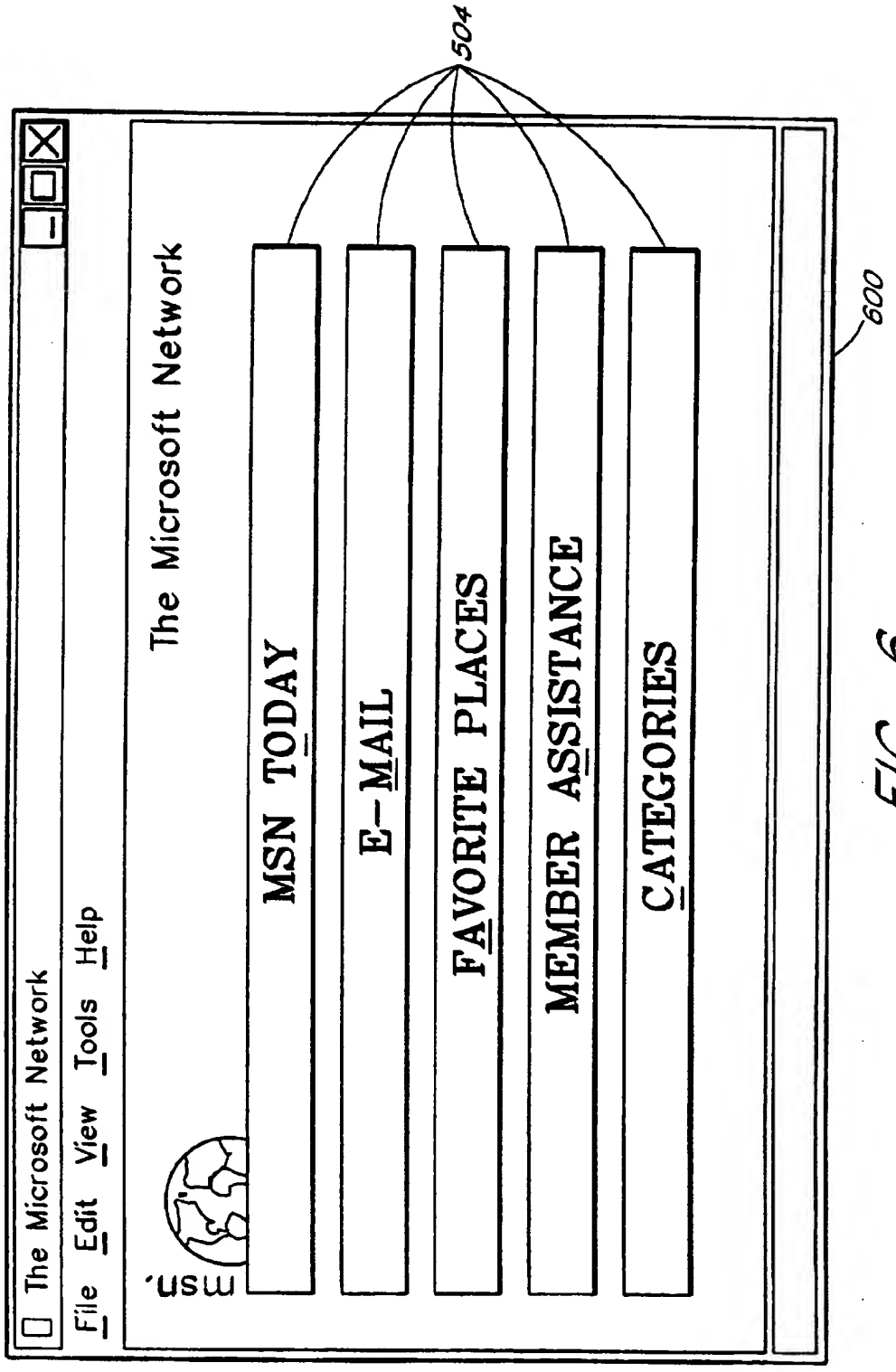

504
The Microsoft Network
File Edit View Tools Help
MSN TODAY
E-MAIL
FAVORITE PLACES
MEMBER ASSISTANCE
CATEGORIES
600

FIG. 6

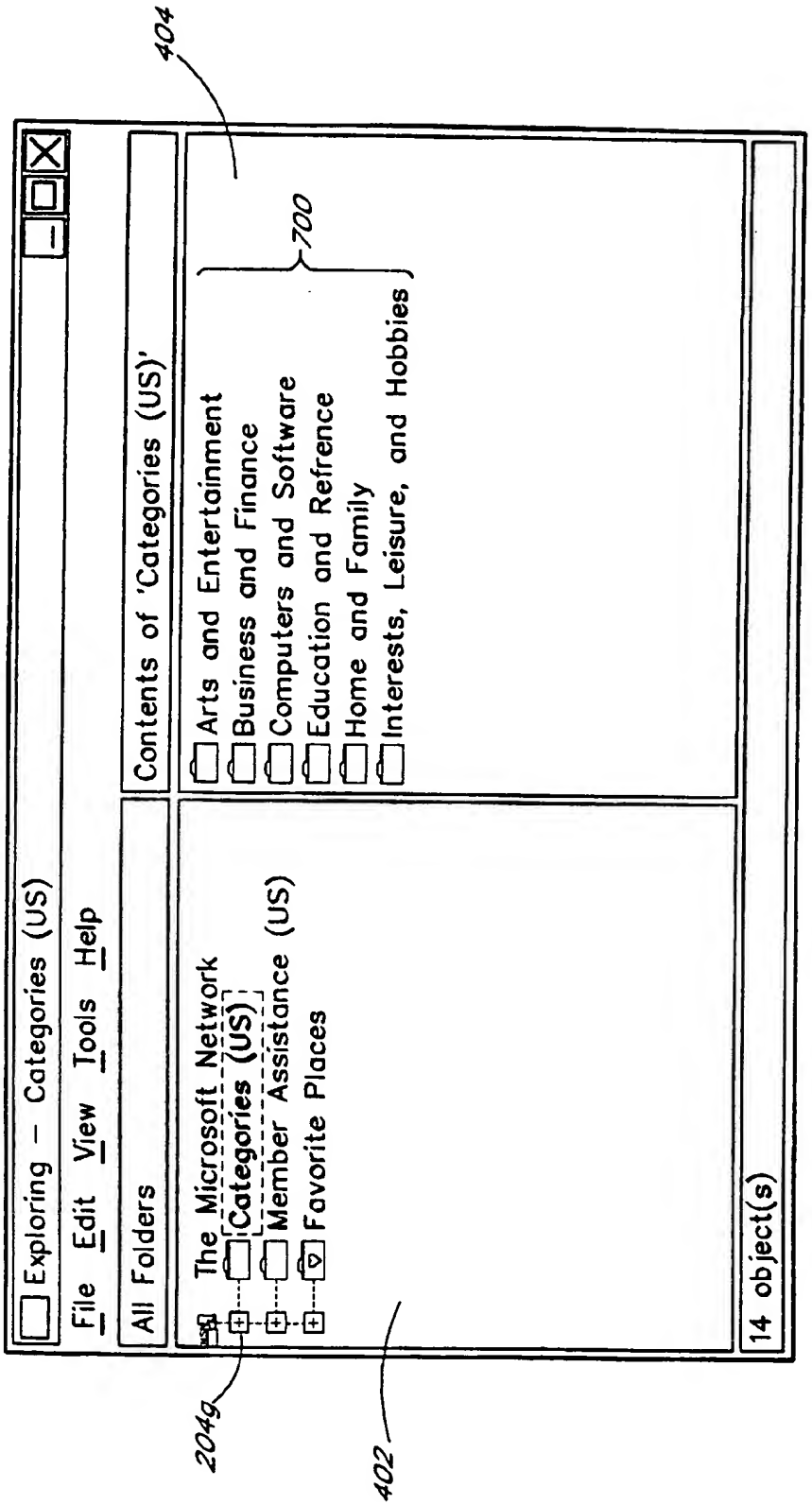

404
Exploring - Categories (US)
File Edit View Tools Help
All Folders
Contents of 'Categories (US)'
The Microsoft Network
Categories (US)
Member Assistance (US)
Favorite Places
Arts and Entertainment
Business and Finance
Computers and Software
Education and Refrence
Home and Family
Interests, Leisure, and Hobbies
700
14 object(s)
204g
402

FIG. 7

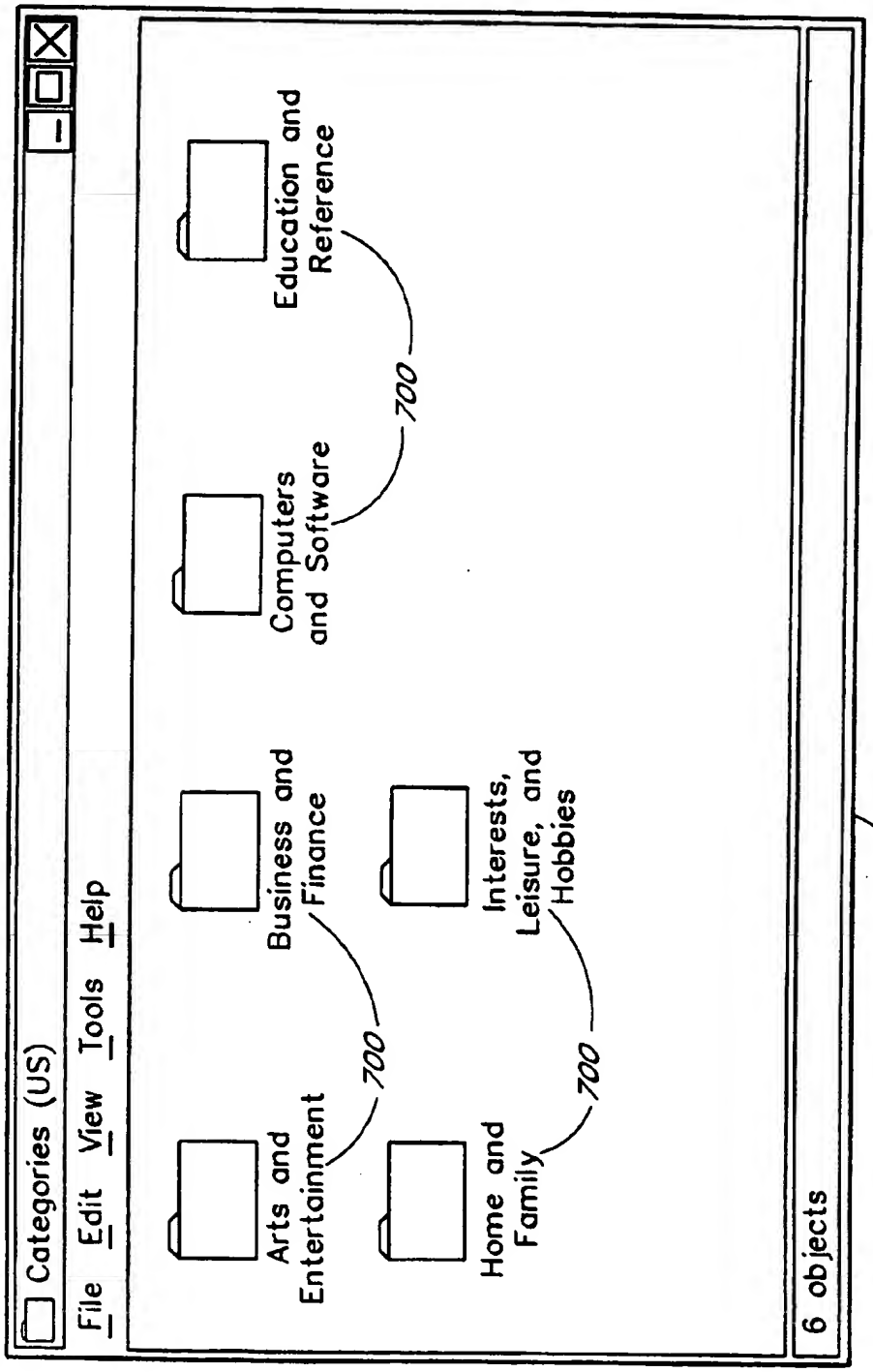

Categories (US)
File Edit View Tools Help
Arts and Entertainment
Business and Finance
Computers and Software
Education and Reference
Home and Family
Interests, Leisure, and Hobbies
700
700
700
800
6 objects

FIG. 8

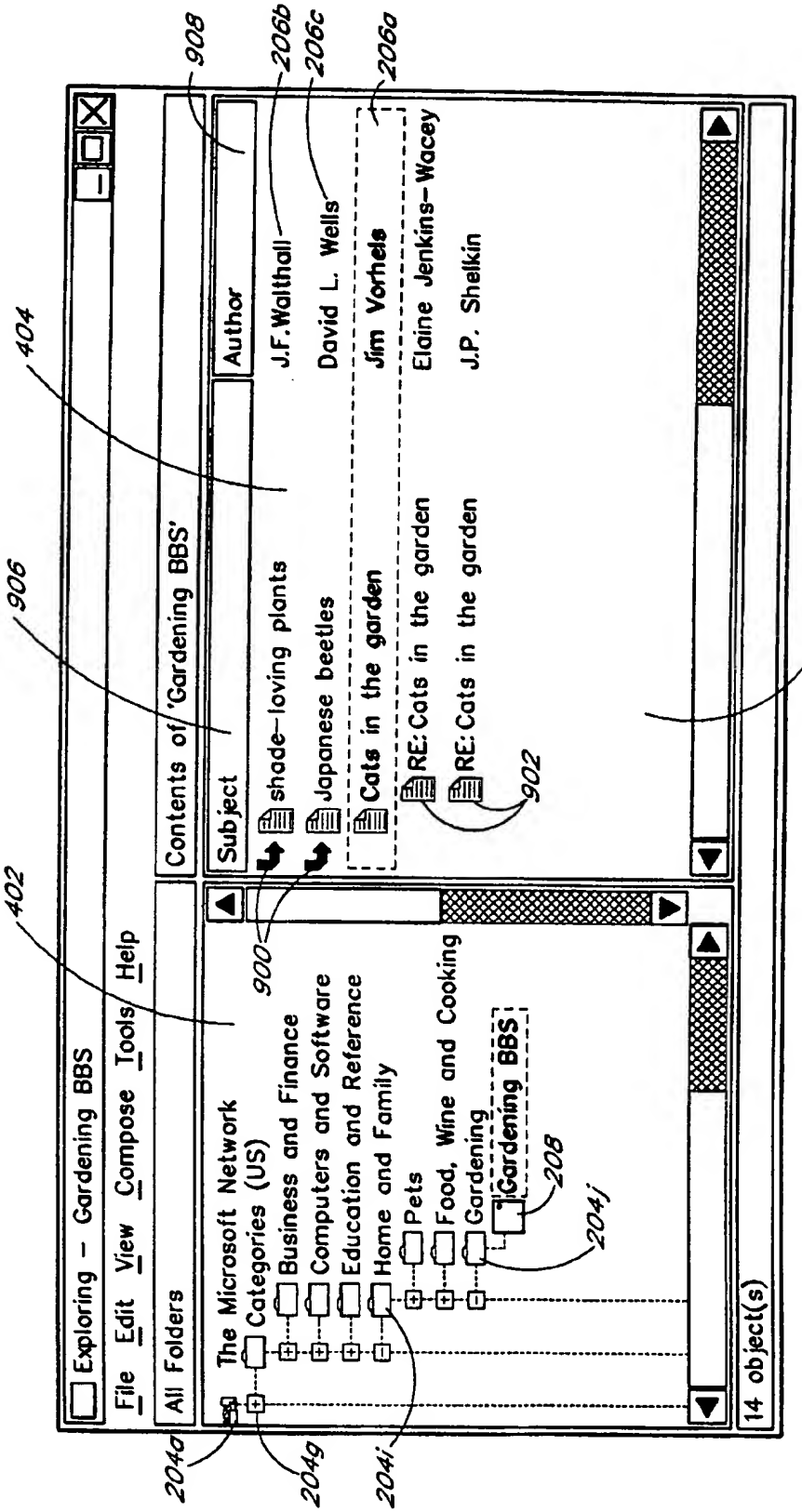

Exploring - Gardening BBS
File Edit View Compose Tools Help
All Folders
Contents of 'Gardening BBS'
Subject
Author
shade-loving plants
J.F. Walthall
Japanese beetles
David L. Wells
Cats in the garden
Jim Vorhels
RE: Cats in the garden
Elaine Jenkins-Wacey
RE: Cats in the garden
J.P. Shelkin
The Microsoft Network
Categories (US)
Business and Finance
Computers and Software
Education and Reference
Home and Family
Pets
Food, Wine and Cooking
Gardening
Gardening BBS
14 object(s)
402
404
906
908
900
902
206a
206b
206c
204a
204g
204i
204j
208

FIG. 9

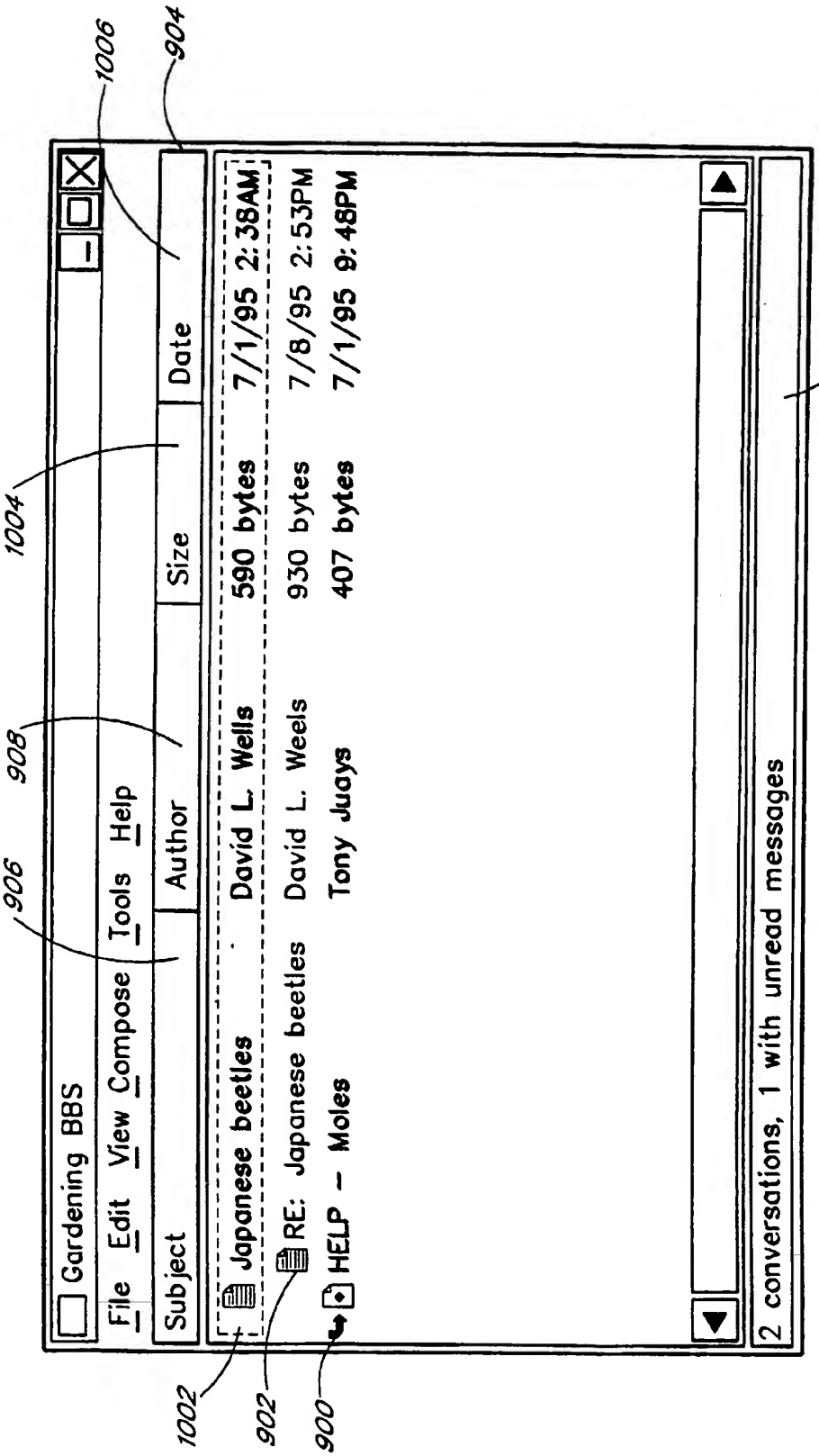
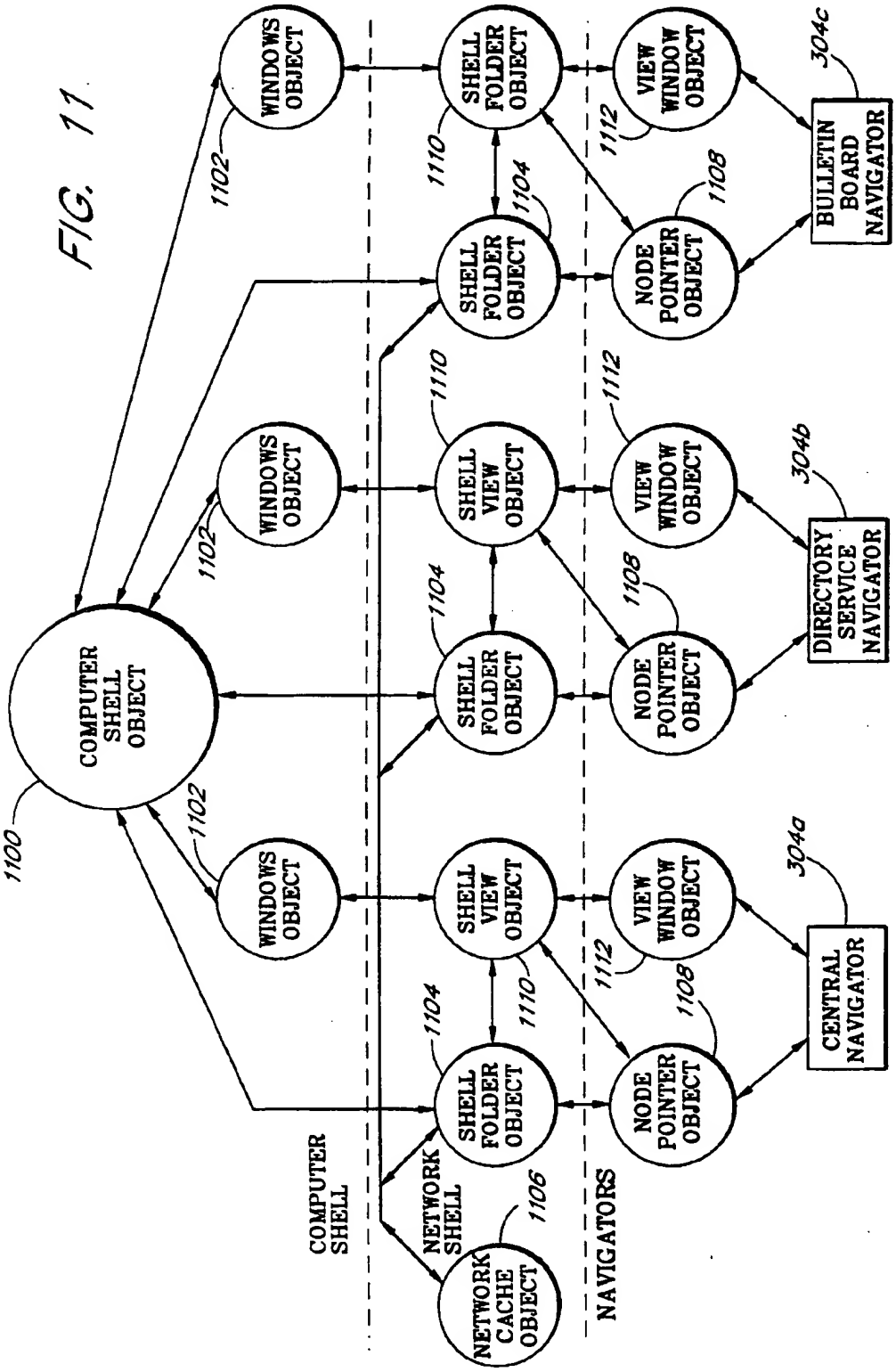

Gardening BBS
File Edit View Compose Tools Help
Subject
Author
Size
Date
Japanese beetles David L. Wells 590 bytes 7/1/95 2:38AM
RE: Japanese beetles David L. Weels 930 bytes 7/8/95 2:53PM
HELP - Moles Tony Juays 407 bytes 7/1/95 9:48PM
2 conversations, 1 with unread messages
1000
1002
902
900
1004
908
906
1006
904

FIG. 10

FIG. 11


COMPUTER SHELL OBJECT
1100
WINDOWS OBJECT
1102
SHELL FOLDER OBJECT
1104
NETWORK CACHE OBJECT
1106
SHELL VIEW OBJECT
1110
VIEW WINDOW OBJECT
1112
NODE POINTER OBJECT
1108
BULLETIN BOARD NAVIGATOR
304c
DIRECTORY SERVICE NAVIGATOR
304b
CENTRAL NAVIGATOR
304a
COMPUTER SHELL
NETWORK SHELL
NAVIGATORS

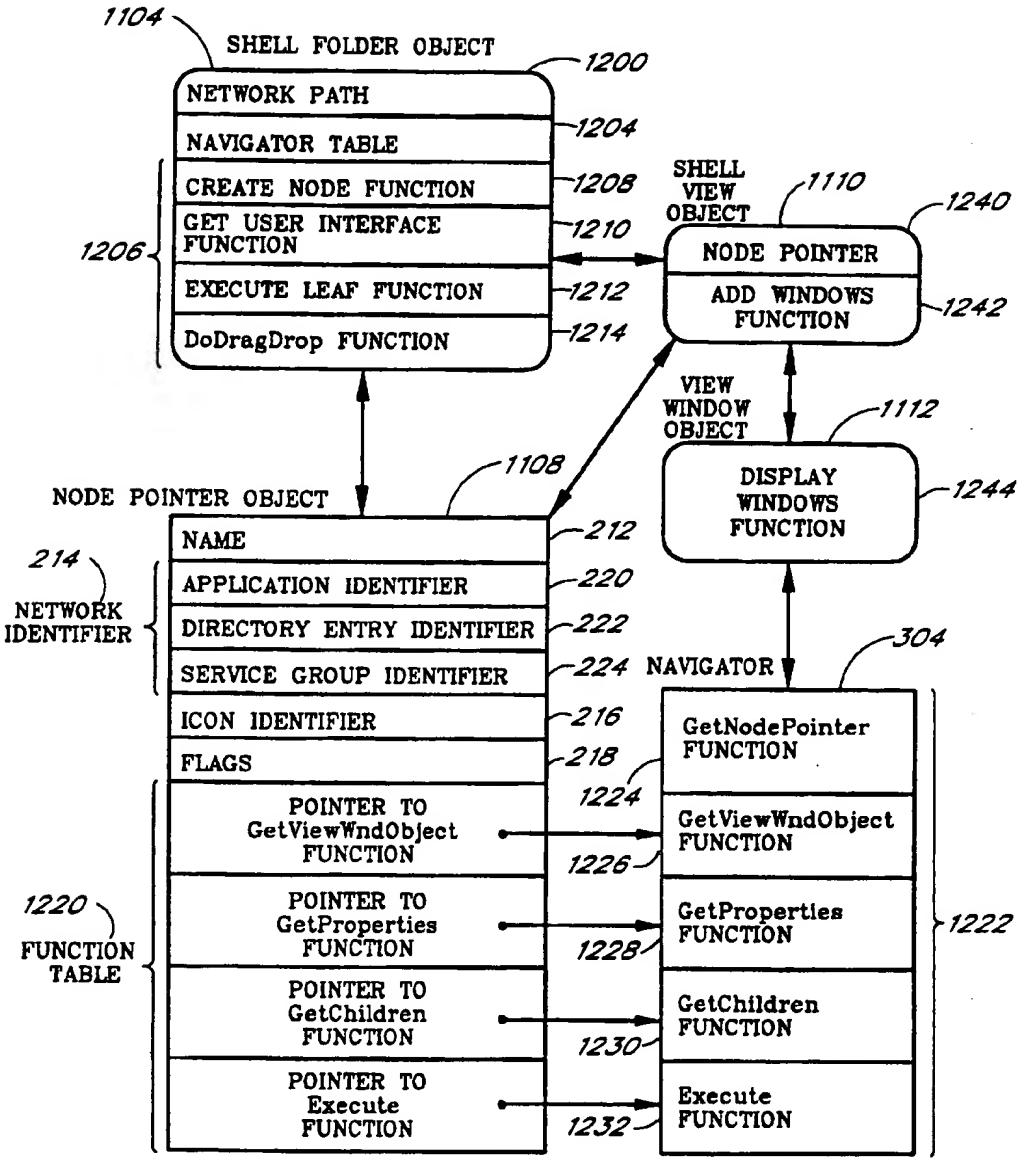

1104
SHELL FOLDER OBJECT
1200
NETWORK PATH
1204
NAVIGATOR TABLE
1208
CREATE NODE FUNCTION
1210
GET USER INTERFACE FUNCTION
1206
1212
EXECUTE LEAF FUNCTION
1214
DoDragDrop FUNCTION
SHELL VIEW OBJECT
1110
1240
NODE POINTER
ADD WINDOWS FUNCTION
1242
VIEW WINDOW OBJECT
1112
DISPLAY WINDOWS FUNCTION
1244
1108
NODE POINTER OBJECT
212
NAME
214
NETWORK IDENTIFIER
220
APPLICATION IDENTIFIER
222
DIRECTORY ENTRY IDENTIFIER
224
SERVICE GROUP IDENTIFIER
216
ICON IDENTIFIER
218
FLAGS
NAVIGATOR
304
1224
POINTER TO GetViewWndObject FUNCTION
GetNodePointer FUNCTION
1226
GetViewWndObject FUNCTION
1220
FUNCTION TABLE
POINTER TO GetProperties FUNCTION
1228
GetProperties FUNCTION
1222
POINTER TO GetChildren FUNCTION
1230
GetChildren FUNCTION
POINTER TO Execute FUNCTION
1232
Execute FUNCTION

FIG. 12

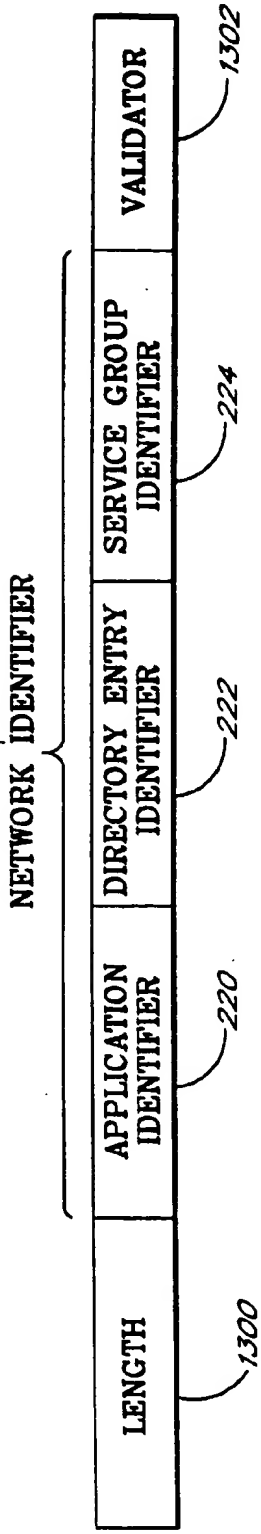

LENGTH
APPLICATION IDENTIFIER
DIRECTORY ENTRY IDENTIFIER
SERVICE GROUP IDENTIFIER
VALIDATOR
NETWORK IDENTIFIER
1300
220
222
224
1302
214

FIG. 13

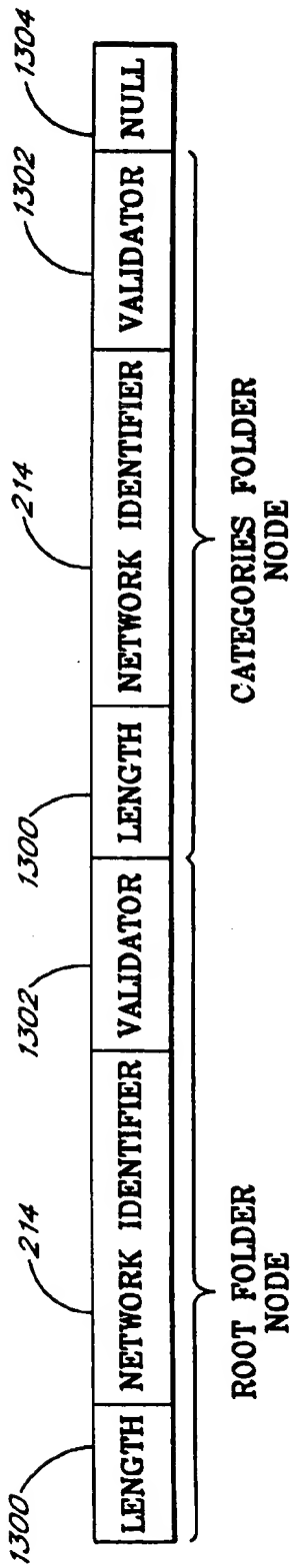

LENGTH
NETWORK IDENTIFIER
VALIDATOR
LENGTH
NETWORK IDENTIFIER
VALIDATOR
NULL
ROOT FOLDER NODE
CATEGORIES FOLDER NODE
1300
214
1302
1300
214
1302
1304

FIG. 14

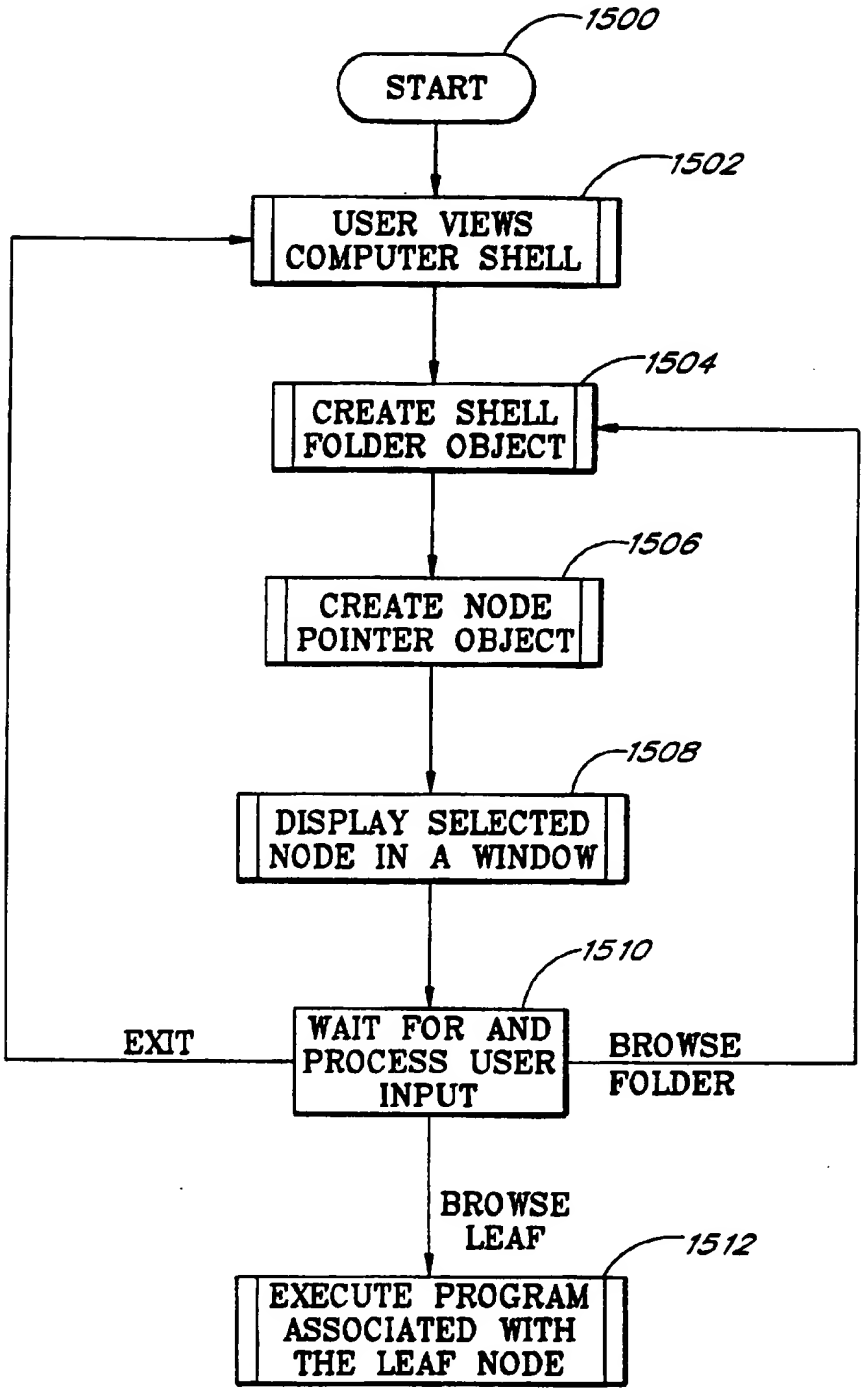

1500
START
1502
USER VIEWS COMPUTER SHELL
1504
CREATE SHELL FOLDER OBJECT
1506
CREATE NODE POINTER OBJECT
1508
DISPLAY SELECTED NODE IN A WINDOW
1510
WAIT FOR AND PROCESS USER INPUT
EXIT
BROWSE FOLDER
BROWSE LEAF
1512
EXECUTE PROGRAM ASSOCIATED WITH THE LEAF NODE

FIG. 15

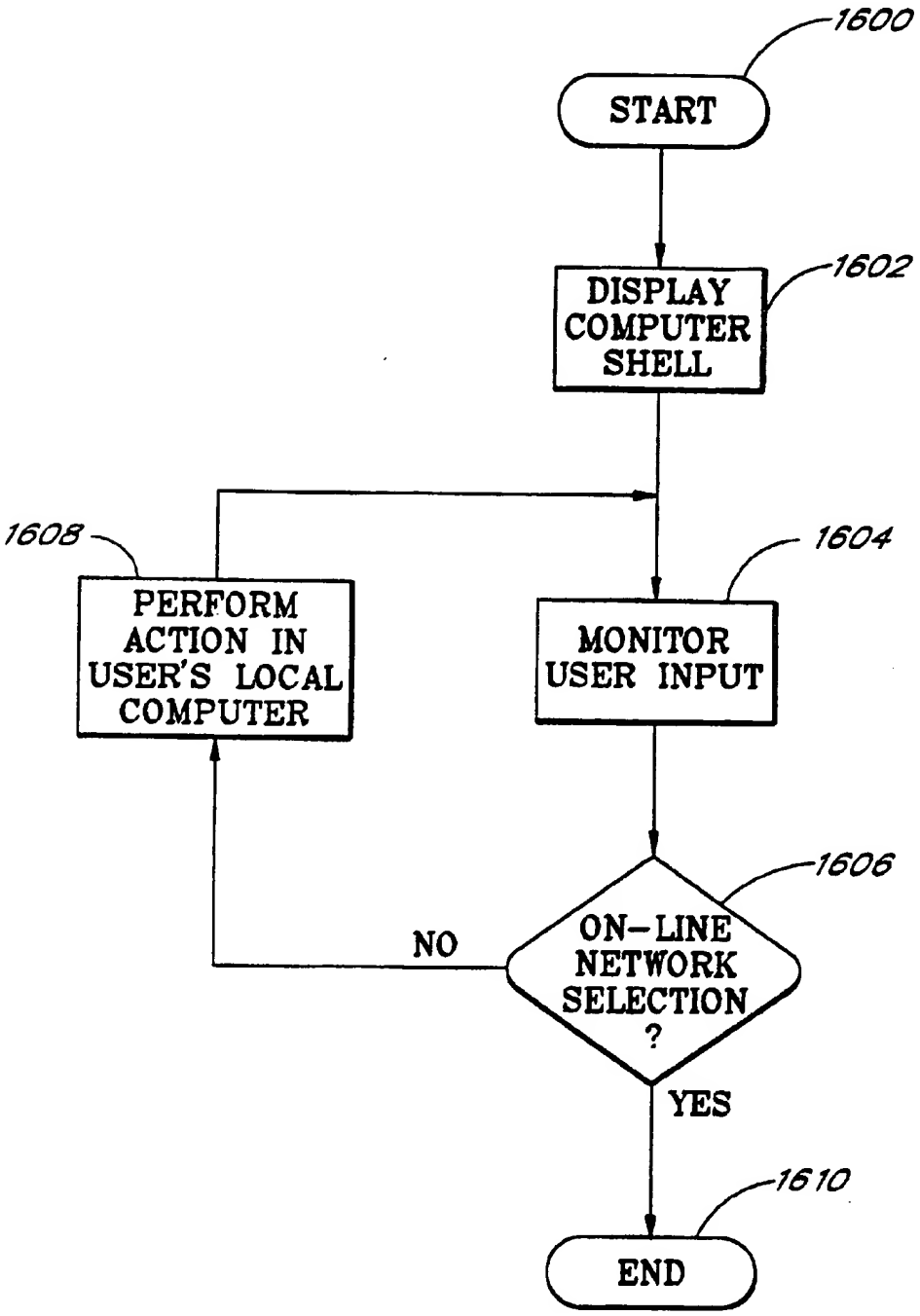

1600
START
1602
DISPLAY COMPUTER SHELL
1608
PERFORM ACTION IN USER'S LOCAL COMPUTER
1604
MONITOR USER INPUT
1606
ON-LINE NETWORK SELECTION ?
NO
YES
1610
END

FIG. 16

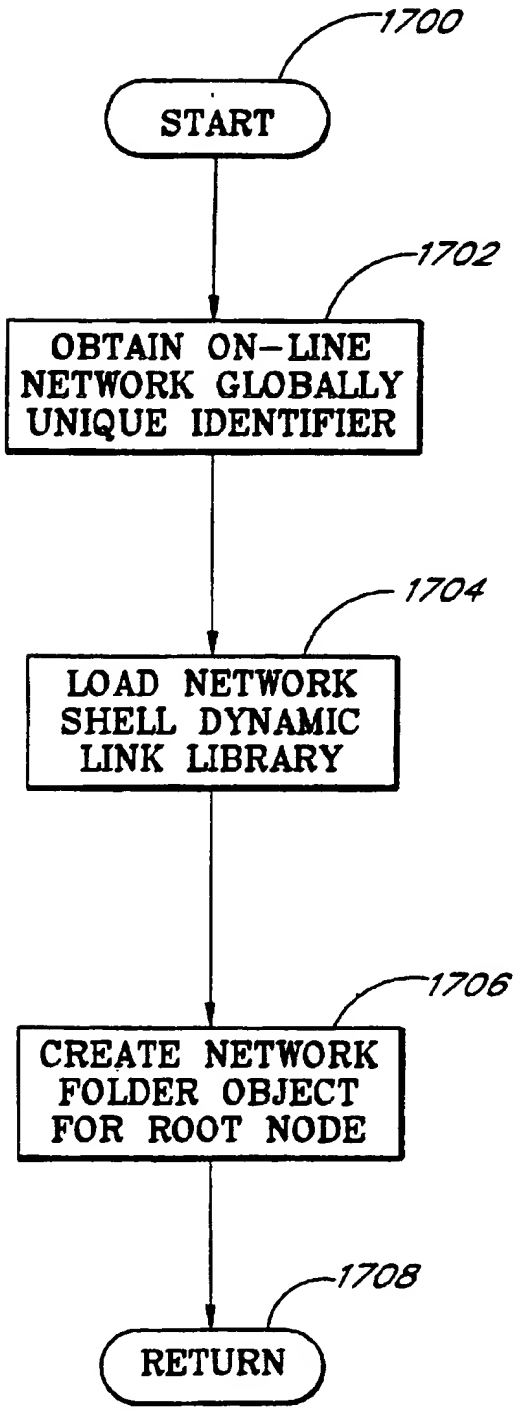

1700
START
1702
OBTAIN ON-LINE NETWORK GLOBALLY UNIQUE IDENTIFIER
1704
LOAD NETWORK SHELL DYNAMIC LINK LIBRARY
1706
CREATE NETWORK FOLDER OBJECT FOR ROOT NODE
1708
RETURN

FIG. 17

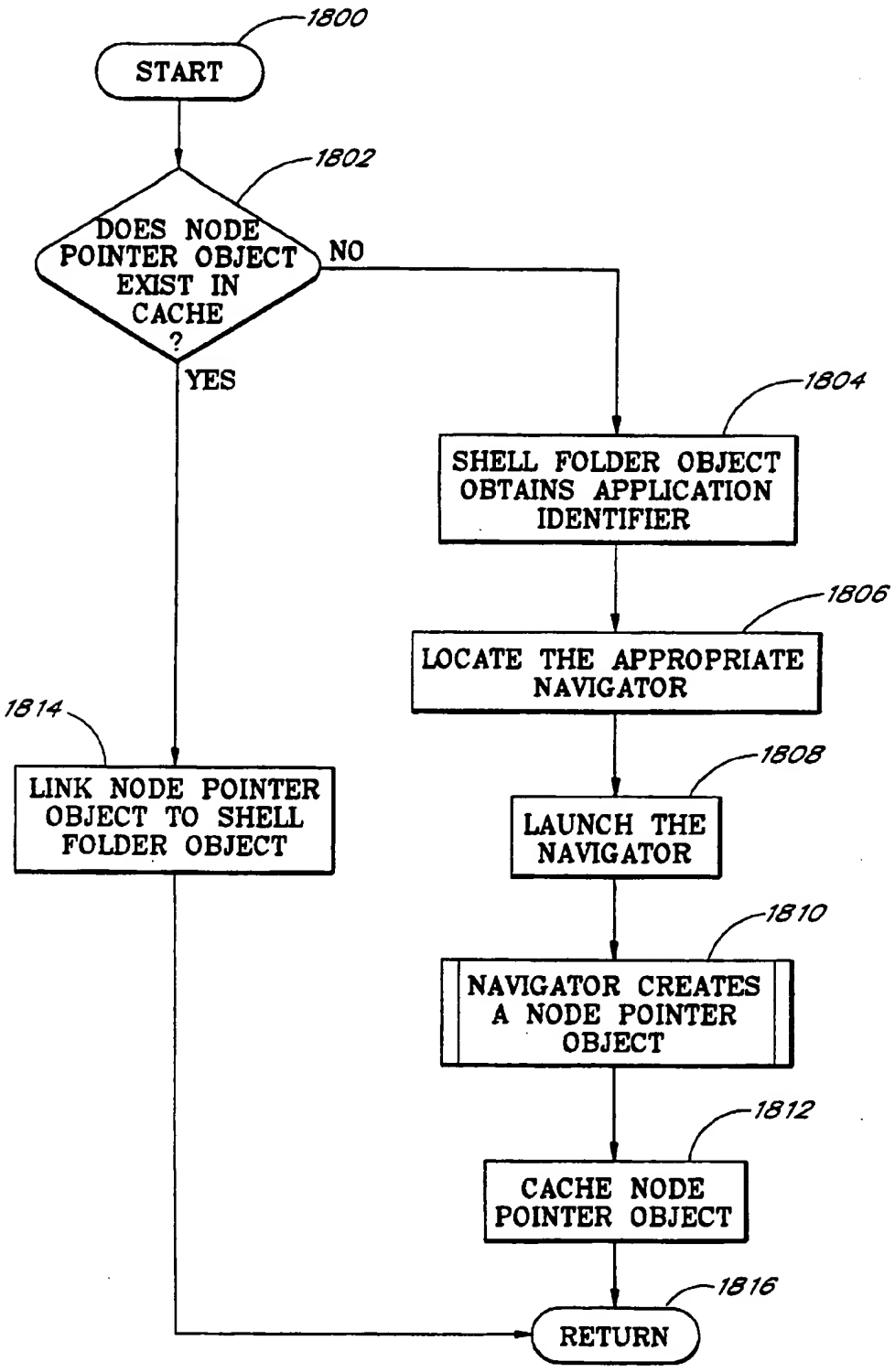

1800
START
1802
DOES NODE POINTER OBJECT EXIST IN CACHE ?
NO
YES
1804
SHELL FOLDER OBJECT OBTAINS APPLICATION IDENTIFIER
1806
LOCATE THE APPROPRIATE NAVIGATOR
1808
LAUNCH THE NAVIGATOR
1810
NAVIGATOR CREATES A NODE POINTER OBJECT
1812
CACHE NODE POINTER OBJECT
1814
LINK NODE POINTER OBJECT TO SHELL FOLDER OBJECT
1816
RETURN

FIG. 18

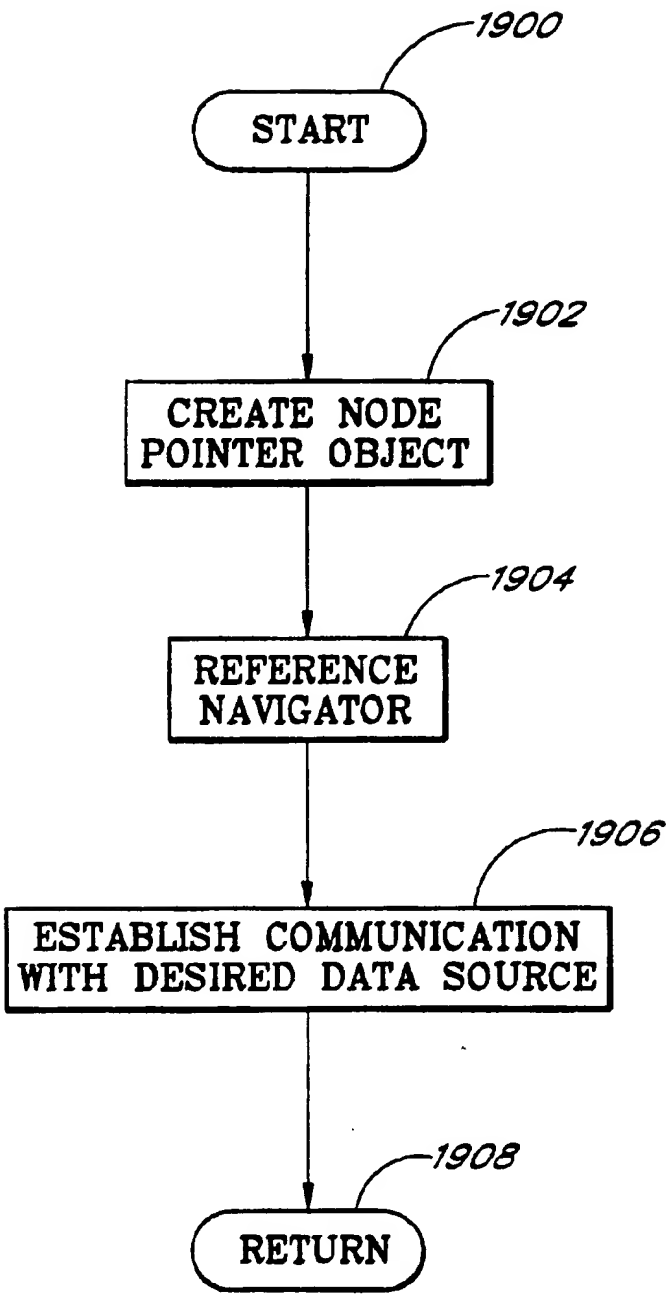

1900
START
1902
CREATE NODE POINTER OBJECT
1904
REFERENCE NAVIGATOR
1906
ESTABLISH COMMUNICATION WITH DESIRED DATA SOURCE
1908
RETURN

FIG. 19

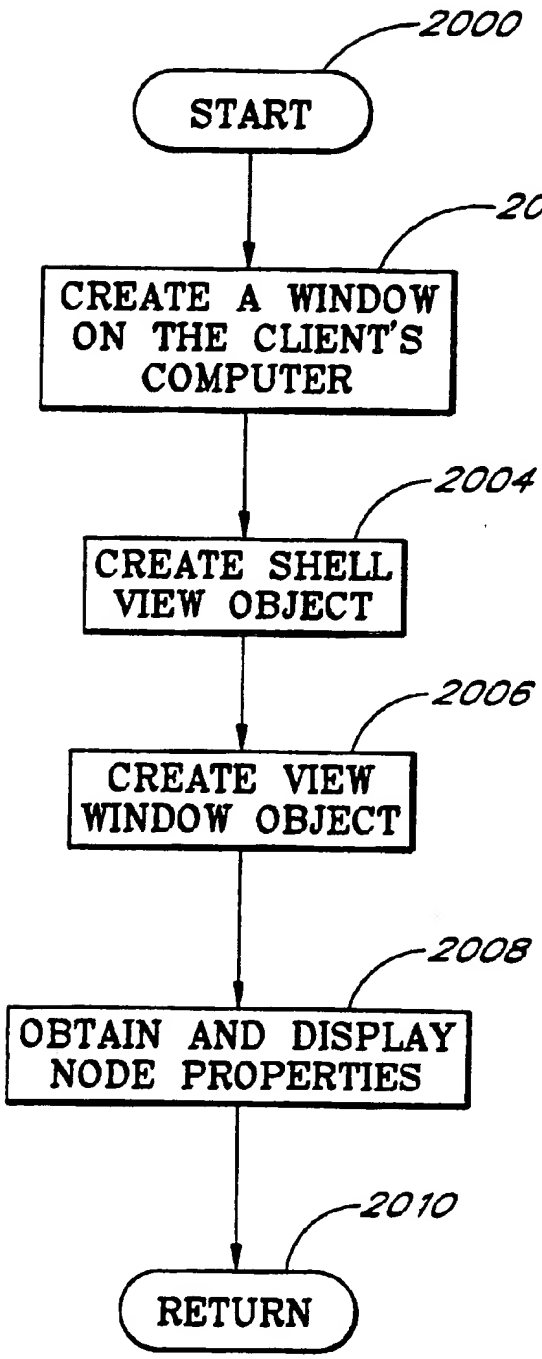

2000
START
2002
CREATE A WINDOW ON THE CLIENT'S COMPUTER
2004
CREATE SHELL VIEW OBJECT
2006
CREATE VIEW WINDOW OBJECT
2008
OBTAIN AND DISPLAY NODE PROPERTIES
2010
RETURN

FIG. 20

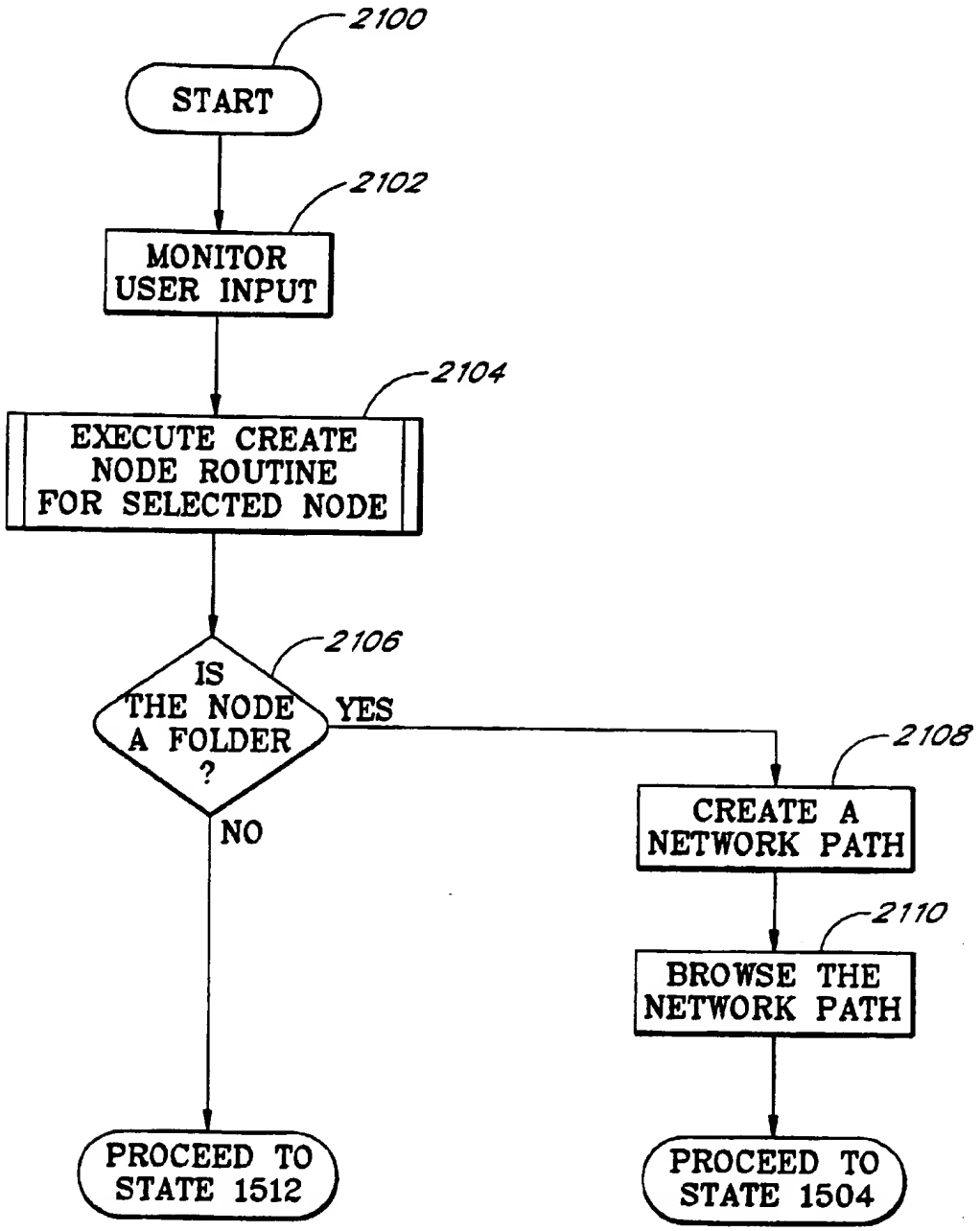

2100
START
2102
MONITOR USER INPUT
2104
EXECUTE CREATE NODE ROUTINE FOR SELECTED NODE
2106
IS THE NODE A FOLDER ?
YES
NO
2108
CREATE A NETWORK PATH
2110
BROWSE THE NETWORK PATH
PROCEED TO STATE 1512
PROCEED TO STATE 1504

FIG. 21

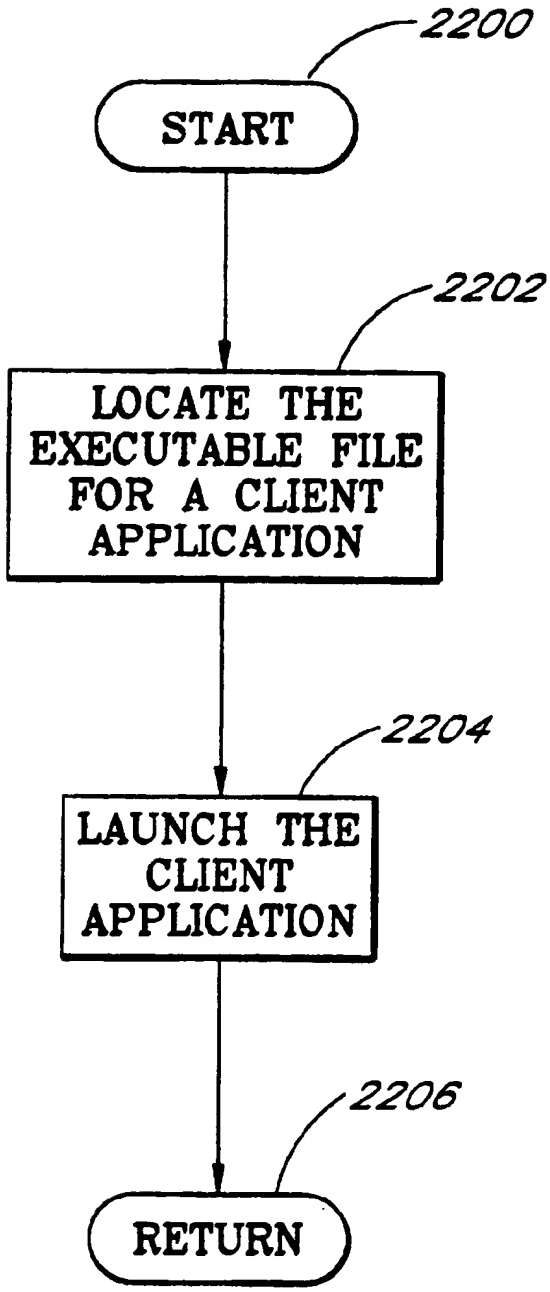

2200
START
2202
LOCATE THE EXECUTABLE FILE FOR A CLIENT APPLICATION
2204
LAUNCH THE CLIENT APPLICATION
2206
RETURN

FIG. 22

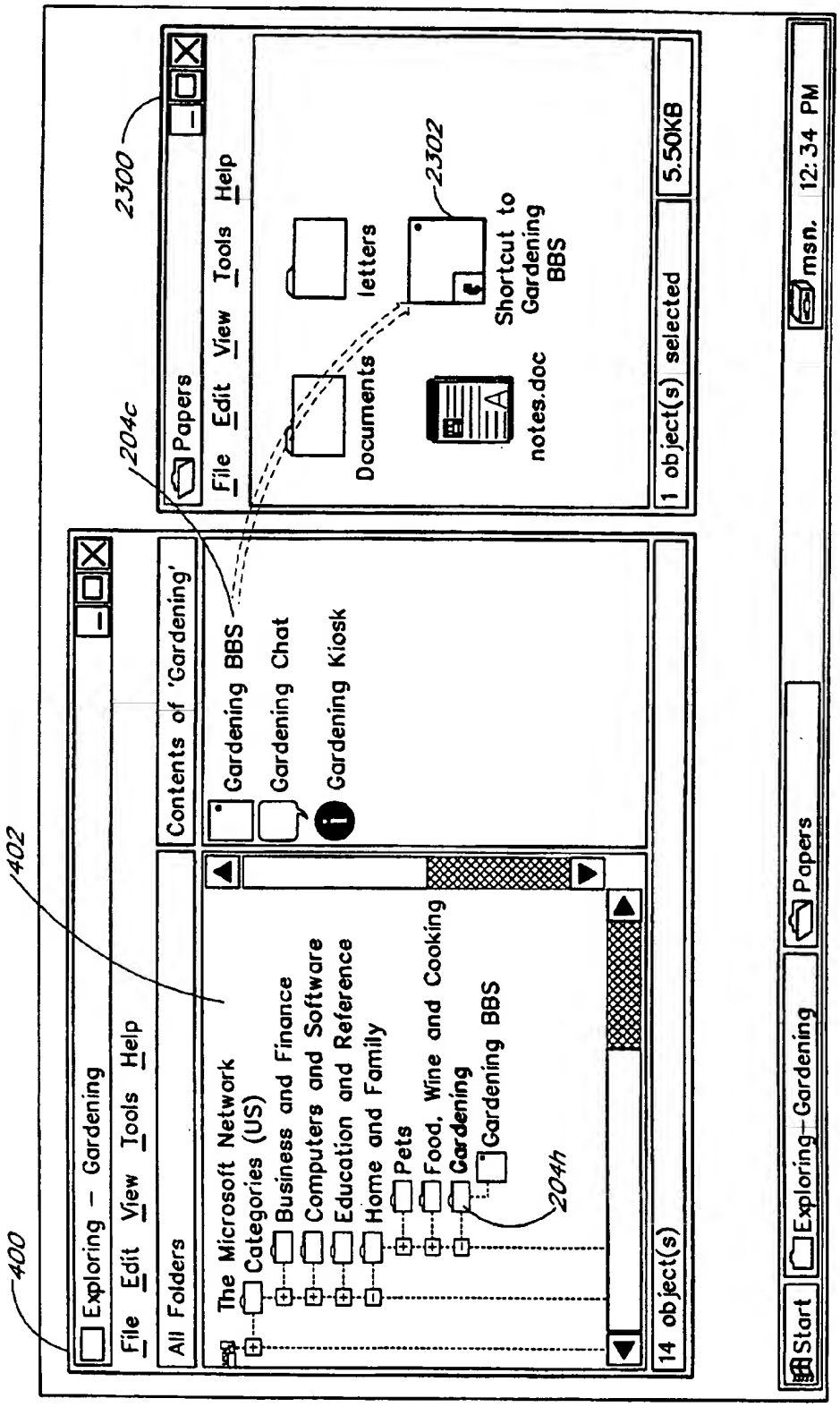

400
402
Exploring - Gardening
File Edit View Tools Help
All Folders
The Microsoft Network
Categories (US)
Business and Finance
Computers and Software
Education and Reference
Home and Family
Pets
Food, Wine and Cooking
Gardening
Gardening BBS
204h
Contents of 'Gardening'
Gardening BBS
Gardening Chat
Gardening Kiosk
14 object(s)
204c
2300
Papers
File Edit View Tools Help
Documents
letters
2302
Shortcut to Gardening BBS
notes.doc
1 object(s) selected
5.50KB
Start
Exploring-Gardening
Papers
msn.
12:34 PM

FIG. 23

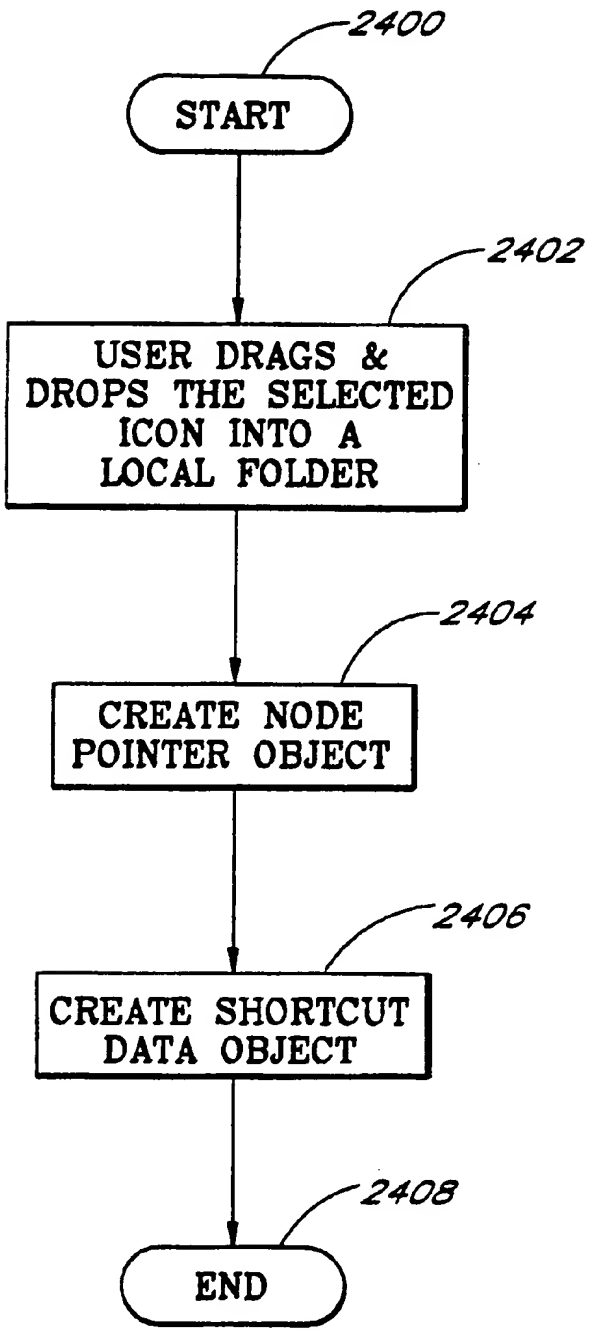

2400
START
2402
USER DRAGS & DROPS THE SELECTED ICON INTO A LOCAL FOLDER
2404
CREATE NODE POINTER OBJECT
2406
CREATE SHORTCUT DATA OBJECT
2408
END

FIG. 24

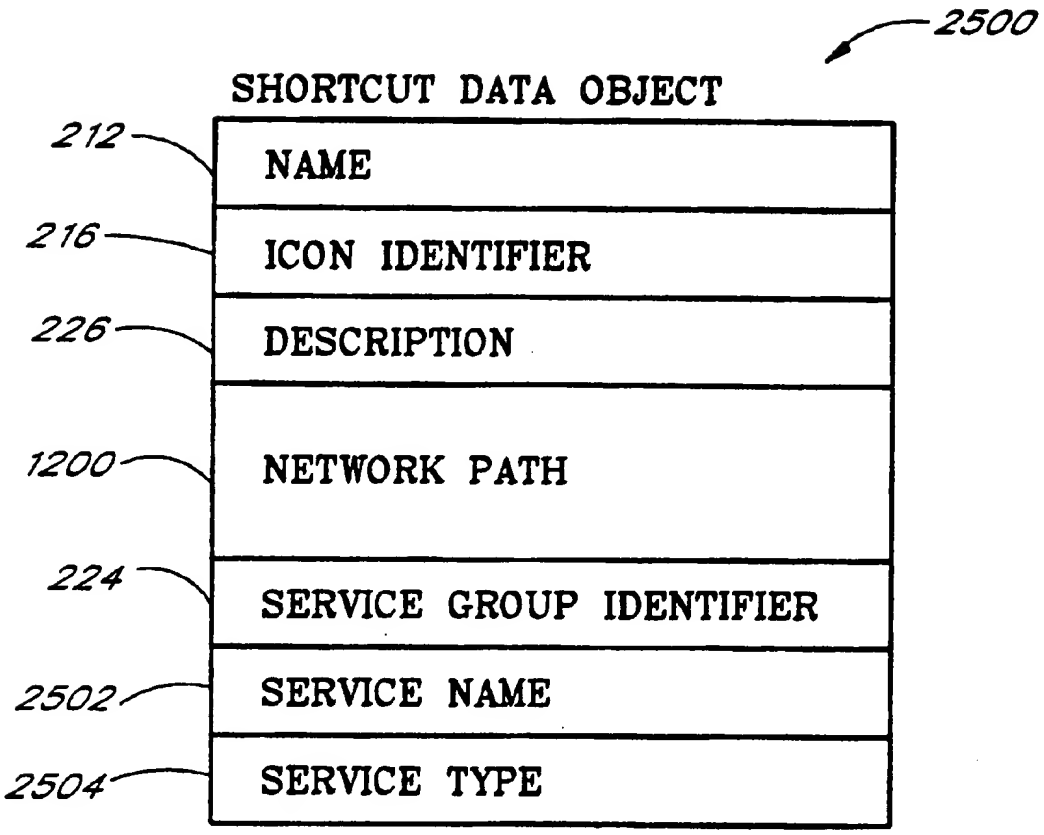

2500
SHORTCUT DATA OBJECT
212
NAME
216
ICON IDENTIFIER
226
DESCRIPTION
1200
NETWORK PATH
224
SERVICE GROUP IDENTIFIER
2502
SERVICE NAME
2504
SERVICE TYPE

FIG. 25

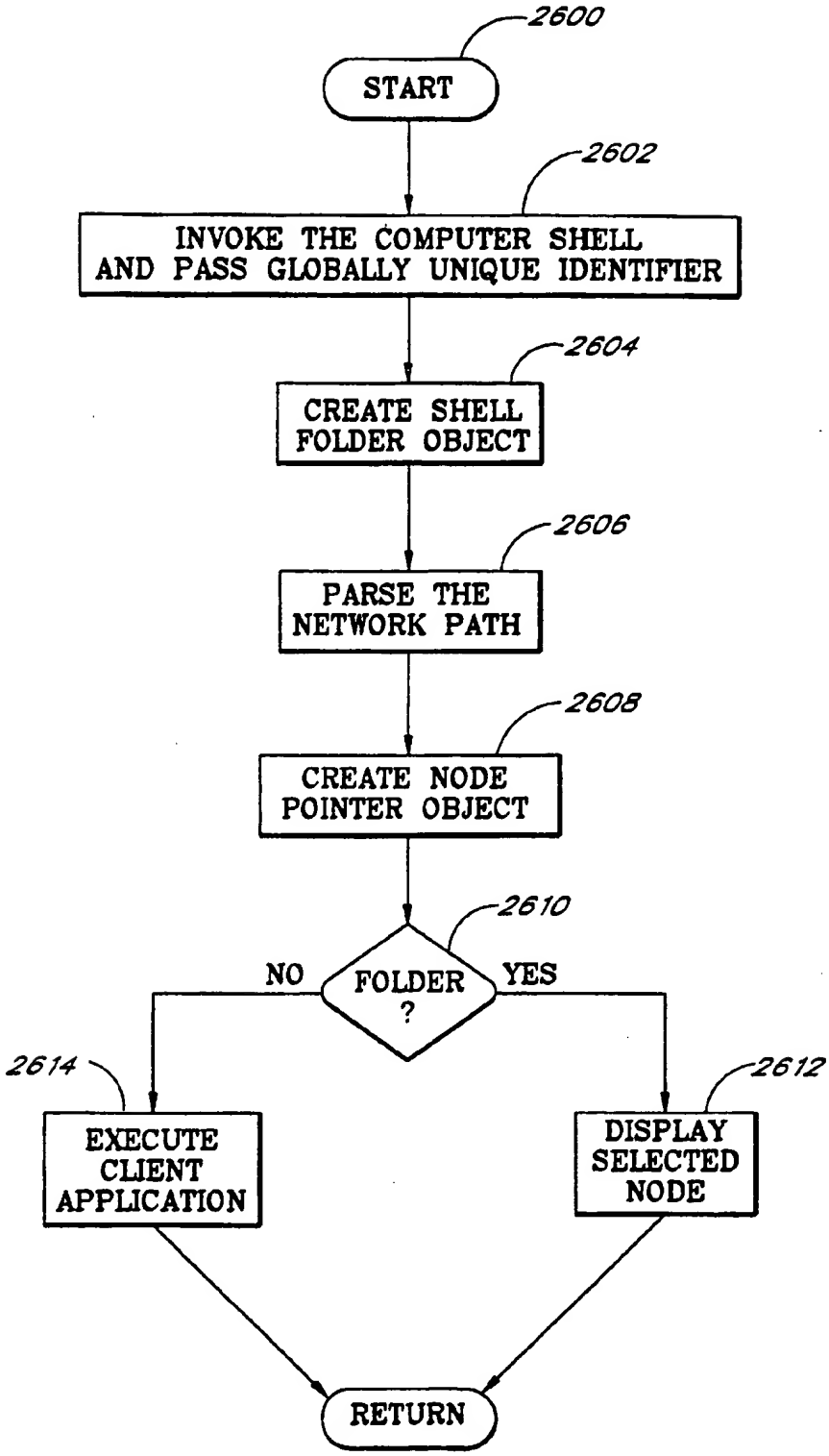

2600
START
2602
INVOKE THE COMPUTER SHELL AND PASS GLOBALLY UNIQUE IDENTIFIER
2604
CREATE SHELL FOLDER OBJECT
2606
PARSE THE NETWORK PATH
2608
CREATE NODE POINTER OBJECT
2610
FOLDER ?
NO
YES
2614
EXECUTE CLIENT APPLICATION
2612
DISPLAY SELECTED NODE
RETURN

FIG. 26

APPARATUS FOR PRESENTING THE CONTENT OF AN INTERACTIVE ON-LINE NETWORK

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to on-line network communication systems and, more particularly, to a system for accessing an interactive on-line network to obtain information-related services.

2. Background

Various on-line networks are currently in existence, including Compuserve, Prodigy, and America On-Line. End users typically access these networks using a microcomputer equipped with a modem. During a logon session, the on-line network displays a user interface which helps guide the user to desired services. To view a particular service, the user must learn the sequence of input commands needed to locate and invoke the desired service.

For example, by entering the proper commands, a user can view a variety of information-related services and communications services, including news services, weather services, bulletin board services, electronic mail, and the like. The visual display created by the on-line network and the input commands which direct the on-line network to perform a desired action are typically called a user interface.

The software which implements a user interface is called a "shell." Thus, the shell is the set of software instructions that (1) create the visual display and (2) process a user's input commands. For example, a network shell provides the visual images and menus which a user sees when accessing an on-line network. Thus, the network shell is the software programming which provides a communication mechanism between the user and the on-line network.

Users of on-line systems spend a significant amount of time locating services, data files, and other information. Typically, a network shell attempts to reduce the amount of time a user spends locating information by providing a user interface which presents the on-line network's organizational structure in a familiar and intuitive manner. Thus, a network shell which is easy to use, familiar and flexible, greatly reduces the time it takes a user to locate resources in an on-line network.

Although known network shells for on-line networks offer many significant benefits, such network shells are still subject to a number of significant limitations. For example, existing network shells are not integrated with the user interface displayed by a local computer's operating system. Further, existing network shells do not adequately communicate the location of a user in the on-line network or provide a means for directly accessing a desired location or service in an on-line network.

In addition, conventional on-line network shells are monolithic. That is, the network shell provides the user interface for the entire network. Anytime the network shell is changed or updated, it affects the entire system. In very large on-line systems, this increases the cost of support, requires frequent network shell updates, and confuses users.

SUMMARY OF THE INVENTION

The present invention provides an enhanced on-line network access system which optimizes an on-line system's user interface. The on-line network access system of the present invention acts as an extension of the user's local operating system and is consistent, intuitive, and extensible.

As explained above, users of on-line systems spend a significant amount of time locating services, data files, and other information. Past systems, however, have not considered providing a network shell that is integrated with a user's operating system so as to provide a familiar user interface. The system of the present invention, operates as an extension of the local computer's operating system.

For example, in the preferred embodiment, the on-line network access system operates as an extension to the Win 95 Explorer a product developed by the Microsoft Corporation. The Win 95 Explorer is the part of the Win 95 operating system that provides the operating system user interface. Accordingly, the present invention communicates with the local computer's operating system to provide a graphical interface which displays the offerings in the on-line network as a hierarchy of folders which are visually similar to the way the operating system displays the folders stored in the computer's local file system.

The on-line network access system of the present invention comprises several component modules. In the preferred embodiment, the component modules of the on-line network access system include a computer shell module, a network shell module, and multiple navigator modules. The computer shell module is the user interface which appears on a user's computer. When a user runs an operating system on his local computer, the computer shell module provides a user interface which displays the files and programs stored on the user's computer.

It is common to allow a user to hierarchically organize information into a directory system which is visually presented as a group of "folders." A folder is an icon which looks much like a regular file folder. Functionally, a folder is used to hold a collection of items such as files, programs and documents. Folders also contain child folders that provide a hierarchical organization much like directories and subdirectories. Further, the computer shell module allows a user to structure the way the files and programs are stored.

In the on-line network of the preferred embodiment, there are three different types of nodes: folders, leaves and junction points. The on-line network folder nodes are like directories. Folder nodes reference other nodes and provide the hierarchical structure in the on-line network. Leaf nodes are nodes which do not reference other nodes and contain non-hierarchical information such a data files and executable programs. Junction point nodes are nodes which link one service area of the on-line network with another service area. Junction point nodes are the "glue" by which different service areas are connected to form the global on-line network.

Thus, the network shell module of the present invention provides a view of the on-line network as a group of folders similar to the group of folders which represent the user's local file system. This generalized folder approach provides a user with a consistent mechanism which allows browsing for folders located in his local computer or browsing for folders located on the on-line network. Users thus interact with the network shell module in a natural way because the on-line network simply appears as an extension of the user's local file system.

Furthermore, current network shells have not considered providing a content map which illustrates the location of a user in the on-line network. The content map of the present invention provides a simple and easy to understand hierarchical view of the offerings in the on-line network. Further, the content map shows the paths which a user can take to locate desired resources within the on-line network.

Another deficiency of current network shells, however, is that they do not contemplate the use of different navigator modules. That is, current network shell modules support a single user interface. A navigator module in the present invention provides a user interface which differs from the user interface provided by the network shell module. When invoked, one of the navigator modules takes control of the user interface and provides a different visual display or a different set of input commands and menus.

The system of the present invention, interacts with multiple navigator modules to provide different user interfaces for different service providers. Thus, a service provider can use an existing navigator module or develop its own navigator module to display different types of folders, menus, icons, visual images, etc. This allows a service provider to tailor its user interface to the service it provides.

For example, many companies currently provide product support services. These product support services already contain unique user interfaces or navigators that allow users to find information in product support databases. With the present invention, a service provider can develop a navigator module that displays the unique user interface that its clients have grown accustomed to.

In another aspect of the present invention, a system of accessing the proper navigator module for a given service provider is provided. When a user accesses a particular on-line service, the navigator module corresponding to the desired service is invoked. The proper navigator module then provides the unique user interface associated with that service provider.

In a further aspect of the invention "shortcuts" are provided which reside in a user's local computer. These shortcuts allow the user to reference particular locations in an on-line network and directly jump to that particular location when the user activates the shortcut. For example, a user may periodically wish to access a bulletin board on gardening. As explained in more detail below, the user selects the desired bulletin board icon and drags the icon to a folder in his local computer. The network shell module then creates a shortcut icon and places the icon in the selected folder in the user's local computer.

When the user wishes to access the gardening bulletin board, the user does not need to logon to the on-line network, input confusing jump commands to maneuver to the proper location and then invoke the gardening bulletin board service. Instead, when the user selects the shortcut icon located in his local computer, the network shell module automatically accesses the on-line network, automatically jumps to the proper location and automatically launches the gardening bulletin board service.

Furthermore, the present invention allows the creator of a shortcut to transfer or electronically mail the shortcut to others. This greatly improves the ease of maneuvering within the on-line network. For example, if a user created a chat room for his friends, he could electronically mail his friends a shortcut which allows his friends to immediately access the desired chat room. Additionally, a magazine service provider could electronically mail shortcuts to potential consumers which allow users of the on-line network to immediately access the magazine service.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects, advantages, and novel features of the invention will become apparent upon reading the following detailed description and upon reference to accompanying drawings in which:

FIG. **1** is a high level drawing illustrating the architecture of an on-line services network in accordance with one embodiment of the invention;

FIG. **2** is a block diagram illustrating one embodiment of the nodal data structure existing in the on-line network accessed by the present invention;

FIG. **3** is a high-level block diagram illustrating the architecture of a preferred embodiment of the present invention;

FIG. **4** is a diagram illustrating the graphical user interface created by the Win 95 Explorer;

FIG. **5** is a diagram illustrating one embodiment of the graphical user interface created by the central navigator module in a preferred embodiment of the present invention;

FIG. **6** is a diagram illustrating another embodiment of the graphical user interface created by the central navigator module in a preferred embodiment of the present invention;

FIG. **7** is a diagram illustrating one embodiment of the graphical user interface created by the directory service navigator module in a preferred embodiment of the present invention;

FIG. **8** is a diagram illustrating another embodiment of the graphical user interface created by the directory service navigator module in a preferred embodiment of the present invention;

FIG. **9** is a diagram illustrating one embodiment of the graphical user interface created by the bulletin board navigator module in a preferred embodiment of the present invention;

FIG. **10** is a diagram illustrating another embodiment of the graphical user interface created by the bulletin board navigator module in a preferred embodiment of the present invention;

FIG. **11** is a detailed block diagram of the data structure created and used by a preferred embodiment of the present invention;

FIG. **12** is a detailed block diagram of a shell folder object, a node pointer object, a shell view object, a view window object and a navigator in the data structure of a preferred embodiment of the present invention;

FIG. **13** is a detailed block diagram of the data format used by a preferred embodiment of the present invention to represent a node in the on-line network;

FIG. **14** is a detailed block diagram illustrating an example of a network path created by a preferred embodiment to represent the path to a particular node in the on-line network;

FIG. **15** is a high-level flow chart illustrating the overall functional operation of a preferred embodiment of the present invention;

FIG. **16** is a flow chart illustrating the functional operation of the computer shell module in a preferred embodiment of the present invention;

FIG. **17** is a flow chart illustrating the invocation of the network shell module in one presently preferred embodiment of the present invention;

FIG. **18** is a flow chart illustrating one embodiment of the create node function invoked to create a node object in one presently preferred embodiment of the present invention;

FIG. **19** is a flow chart illustrating one embodiment of the GetNodePointer function invoked to link a node pointer object to a particular navigator module in a preferred embodiment of the present invention;

FIG. **20** is a flow chart illustrating the display of a on-line network node on a user's computer in a preferred embodiment of the present invention;

FIG. **21** is a flow chart illustrating one embodiment of the function invoked to identify a folder node or a leaf node in the present invention;

FIG. **22** is a flow chart illustrating one embodiment of the execute function which invokes an executable program associated with a leaf node in the on-line network of the present invention;

FIG. **23** is a diagram illustrating one embodiment of the user interface which shows a shortcut on the user's local file system;

FIG. **24** is a flow chart illustrating the creation of a shortcut in a preferred embodiment of the present invention;

FIG. **25** is a block diagram of a shortcut data object in a preferred embodiment of the present invention; and

FIG. **26** is a flow chart illustrating the invocation of a shortcut in a preferred embodiment of the present invention.

In the drawings, the first digit of any three-digit number indicates the number of the figure in which the element first appears. For example, an element with the reference number **402** first appears in FIG. **4**. Where four-digit reference numbers are used, the first two digits indicate the figure number.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The detailed description which follows is broken up into the following sections: ARCHITECTURAL OVERVIEW, ORGANIZATION OF THE ON-LINE NETWORK CONTENT, THE NETWORK SHELL, and SHORTCUTS.

1. Architectural Overview

FIG. **1** is a high level drawing illustrating the architecture of an on-line network **100** in accordance with one embodiment of the invention. The on-line network **100** includes multiple local computers **102** connected to a host data center **104** by one or more wide area networks (WANs) **106**. The wide area network **106** of the preferred embodiment includes wide area network (WAN) lines **108** which are provided by one or more telecommunications providers. The wide area network **106** allows users of the local computers **102**, dispersed over a wide geographic area, to access the host data center **104** via a modem.

The host data center **104** comprises a plurality of servers **120** connected to a high speed local area network (LAN) **122**. Also connected to the local area network **122** are multiple Gateways **124** linking incoming calls from end users to the servers **120**. In the preferred embodiment, the servers **120** and the Gateways **124** are Pentium-class (or better) microcomputers which run the Windows NT operating system available from Microsoft Corporation.

The servers **120** typically have at least 128 MB of random-access memory (RAM) and at least 4 GB of disk space. Processing power may vary from server to server. For example, one server **120** may have four 100 Mhz processors, while another server **120** may have one 90 Mhz processor. Each Gateway **124** typically has at least 64 MB of RAM and at least 2 GB of disk space, and is capable of supporting approximately 1000 simultaneous users at T1 (1.544 Mbps) or greater data rates. The local area network **122** is preferably a 100 Mbps LAN based on the CDDI (Copper Distributed Data Interface) standard. The CDDI specification is a variant of the well-known ANSI Fiber Distributed Data Interface specification, but uses a single copper ring instead of a dual fiber ring.

The host data center **104** also includes multiple Arbiter microcomputers **126** (hereinafter referred to as "Arbiters") which monitor, record and process certain types of transactions to ensure consistency among servers **120**. The host data center **104** also includes one or more custom Gateway microcomputers **130** which link the host data center **104** to one or more external service providers **132**, such as a news provider, a stock quote service or a credit card service which validates and executes credit card transactions. Each custom Gateway microcomputer **130** uses the communications protocol required by the external service provider **132** to which the custom Gateway is linked.

During a typical logon session, a client user maintains a communications link with a single Gateway **124**, but may access multiple service applications (and thus communicate with multiple servers **120**). The Gateway performs protocol translation, translating messages between the protocol of the wide area network **106** and the protocol of the local area network **122** and establishes links between a local computer **102** and a particular server **120**.

The host data center **104** provides a variety of communications-based and information-based on-line services to client users. Typical services include, for example, a directory service, a bulletin board service, an electronic mail service, a chat service, a media view service, an interactive game service and various news services.

The directory service (also called the DirSrv service) provides a hierarchical data structure of the on-line network content. The bulletin board service (BBS) allows users to post and review bulletins on specific topics. With the bulletin board service, users conduct non-real-time conversations by posting messages to different bulletin boards. The electronic mail service allows users to send electronic mail messages to one another. The chat service allows users to communicate in real time with one another on specific topics. The mediaview service provides users with a service for viewing on-line multimedia titles. The interactive games service allows users to compete against one another in real time in on-line interactive games, and the news services provides access to news and magazine articles.

The services offered to users of the on-line network **100** are in the form of client-server application programs. The client applications execute on the users local computer while the service applications execute on one or more of the servers. In the presently preferred embodiment, the client applications are implemented as Win 95 executables and the server portions are implemented as dynamic link libraries which execute under the Microsoft Windows NT operating system.

2. Organization Of The On-line Network Content

Referring to FIG. **2**, the on-line network is organized into a hierarchical data structure **200** similar to a hierarchical tree. Each item in the structure is referred to as a "node." In the preferred embodiment, the hierarchical data structure is an acyclic graph which allows the linking of nodes on one branch of the hierarchical tree to reference nodes on other branches of the hierarchical tree.

In the preferred embodiment, the hierarchical data structure **200** is called a global namespace **200**. The global namespace **200** is a network abstraction layer which hides the hardware-dependent details such as the gateways **124**, the arbiters **126** and the servers **120** which comprise the on-line network **100**. The global namespace **200** is further subdivided into different subsections called directory service provider namespaces **202** (hereinafter called "service namespaces **202**"). In this example, the global namespace **200** is subdivided into two service namespaces—a bulletin board namespace **202***a* and a directory service namespace **202***b*.

In one embodiment of the present invention, as discussed in more detail below, each service namespace **202** corre-

sponds to a service group. Furthermore, each service namespace **202** contains a portion of the hierarchial structure of nodes for its service group. Thus, in this example, the bulletin board namespace **202***a* contains the nodes associated with the bulletin board service (also called the BBS service group) and the directory service namespace **202***b* contains the nodes associated with the directory service (also called the DirSrv service group).

A service namespace **202** contains three different types of nodes—folder nodes **204**, leaf nodes **206** and junction point nodes **208**. Folder nodes **204** are like directories. Folder nodes **204** provide the hierarchical structure in a service namespace **202** because folder nodes reference other nodes. Leaf nodes **206** do not reference other nodes and contain non-hierarchical information such as executable programs and data files. Junction point nodes **208** link one service namespace **202** with another service namespace **202**. Junction point nodes **208** are the "glue" by which different service namespaces **202** are connected to form the global namespace **200**.

As explained above, the bulletin board service allows users to post and review messages on different bulletin boards. In this example, bulletin boards and groups of related bulletin boards are referenced by folder nodes **204**. The bulletin board namespace **202***a* illustrated in FIG. **2** contains a bulletin board service folder node **204***b*, a gardening folder node **204***c* and a new products folder node **204***d*.

Leaf nodes **206** do not reference other nodes and in this example, different bulletin messages are represented as leaf nodes **206** in the bulletin board service namespace. In this example, the gardening bulletin board folder node **204***c* contains three messages, a "cats in the garden" leaf node **206***a*, a "shade loving plants" leaf node **206***b* and a "japanese beetles" leaf node **206***c*. The new products folder node **204***d* contains a single message, a "new product press release" leaf node **206***d*.

The directory service namespace **202***b*, in one embodiment of the on-line network **100**, contains the on-line information content that is not within the bulletin board namespace **202***a*. The directory service namespace **202***b* organizes the information content with folder nodes **204**. In this example, the directory service namespace **202***b* contains a member assistance folder node **204***e*, a favorite places folder node **204***f* and a categories folder node **204***g*. The categories folder node **204***g* references an arts and entertainment folder node **204***h* and a home and family folder node **204***i*. The home and family folder node **204***i* references a gardening folder node **204***j*.

The directory service namespace **202***b* in one embodiment of the present invention, stores programs, documents and images as leaf nodes **206**. In this example, the member assistance folder node **204***e* references a customer support leaf node **206***e* which contains a document about customer support information. The gardening folder node **204***j* contains a gardening information leaf node **206***g*. As discussed in more detail below, the gardening folder node **204***j* also contains a gardening bulletin board junction point node **208**.

In addition to the folder nodes **204** and leaf nodes **206**, the directory service namespace **202***b* is linked to the bulletin board namespace **202***a* via the gardening bulletin board junction point node **208**. As explained above, junction point nodes **208** link one service namespace with another service namespace. In this example, the gardening bulletin board junction point node **208** links the gardening folder node **204***j* to the gardening bulletin board **204***c*. Thus a user accessing information about gardens can easily access a bulletin board which discusses various gardening techniques.

In the preferred embodiment, each node **204**, **206**, and **208** contains a set of node properties **210**. The set of node properties **210** contain the node's name **212**, a network identifier **214**, an icon identifier **216**, flags **218** and a description **226** and other items **228**. The node's name **212** is a human readable name that may be displayed with the node's corresponding icon such as the "gardening" name in the gardening folder node **204***j*.

The network identifier **214** is a 128-bit number which comprises an application identifier **220**, a directory entry identifier **222** and a service group identifier **224**. The application identifier **220** is a 32-bit number which identifies a particular service namespace **202**. Thus, in the preferred embodiment of the present invention, the application identifier **220** uniquely identifies up to approximately four billion (2^{32}) service namespaces **202**.

Currently three application identifiers **220** are assigned to particular namespaces **202**. The following table describes the defined meaning of the three application identifiers in the preferred embodiment.

TABLE 1

APPLICATION IDENTIFIER	DEFINED MEANING
0x0001	Directory Service Namespace
0x0002	Bulletin Board Namespace
0x0003	Root Node

The directory entry identifier **222** is a 64-bit number which uniquely identifies each node in a particular service namespace **202**. Thus, the directory entry identifier **222** of the present invention advantageously identifies up to approximately 18 billion, billion (2^{64}) nodes within a service namespace **202**. The service group identifier **224** is a 16-bit number which advantageously identifies a group of servers.

The icon identifier **216** identifies the icon image or bit-map associated with each node. The flags **218** identify whether the node is a folder node, a leaf node or a junction point node. The description **226** contains a description of the node and contains up to **255** characters. The other items **228** include a security token, strings, and other properties that a service provider can define. Thus, in addition to providing the set of properties **210** listed above, the present invention allows service providers to create their own node properties.

3. The Network Shell

The global namespace **200** in the on-line network **100** will become an enormous hierarchical data structure. In addition, as discussed in more detail below, each service namespace **202** within the global namespace **200** has the ability to grow into a very large hierarchical data structure. As a result, the network shell needs to provide a simple, intuitive and extensible user interface which assists a user as he maneuvers about the on-line network.

FIG. **3** illustrates a block diagram of the on-line network access system in a preferred embodiment of the present invention. The present invention generally contains multiple modular components including a computer shell module **300**, a network shell module **302**, and one or more navigator modules **304** which communicate with server applications **318** on the on-line network **100**. As explained in more detail below, these modules interact to provide a flexible and extensible system for browsing the on-line network **100**.

The services offered by the on-line network **100** are in the form of client-server application programs. Each client-server application includes a client application **310** and a server application **318**. In the presently preferred

embodiment, the client application **310** runs on the local computer **102** and includes the computer shell module **300**, the network shell module **302**, and one or more navigator modules **304** which are in communication with the server applications **318** existing on the servers **120**. In this example, the server applications **318** include the bulletin board service **318***a* and the directory service **318***b*.

In the present invention, a network layer **306** in the client processor **102** manages the communications between the client application **310** and the server applications **318**. The network layer **306** in the local computer **102** communicates via a modem **308** over the wide area network **106** with the host data center **104**. A gateway network layer **314** exists on each gateway **124** which interfaces with the wide area network **106**. The gateway **124**, in turn, establishes communication links with desired server applications **318** via the local area network **122**. A person skilled in the art can appreciate that the network layer **306** and the gateway network layer **314** can be implemented using any number of different protocols and computer configurations without departing from the scope of the present invention.

Turning now to the modular components in the client application **310** of the present invention, the computer shell module **300** (hereinafter referred to as the computer shell **300**) provides the user with a means of control over his own computer. The user can use the computer shell **300** to direct his local computer **102** to locate files, invoke programs and the like. In the preferred embodiment, the computer shell **300** is the Microsoft Win 95 Explorer.

FIG. **4** illustrates the user interface created by the Win 95 explorer. The Win 95 explorer displays a two-pane window **400**. The left pane **402** contains a hierarchical map which displays the storage devices and folders in a user's computer. The right pane **404** contains the contents of a selected folder. In addition, the Win 95 explorer contains a command menu **406**. The Win 95 explorer is further described in *Inside Windows* 95, Microsoft Press, 1994, which is hereby incorporated by reference.

For example, in FIG. **4**, the left pane indicates that the user has selected the papers folder **408** (the folder is highlighted and appears to be open) and the right pane displays the contents of the papers folder. In this example, the left pane **402** of the Win 95 Explorer shows that the papers folder is located on the C: drive in the user's local computer (called My Computer in this example). The right pane **404** indicates that the papers folder contains a documents folder and a letters folder. In addition, the papers folder also contains a document called "notes.doc."

As described in more detail below, a user can select the on-line network **100** from within the computer shell **300**. Selection of the on-line network **100** could include, for example, selection of an on-line network icon, selection of the on-line network **100** via a menu, the input of a textual command, voice input, etc. In the present invention, when the user selects the on-line network **100**, the computer shell **300** generates an on-line network globally unique identifier. In the preferred embodiment, the globally unique identifier is the network identifier **214** for the root folder node **204***a* of the on-line network **100**.

The computer shell **300** sends the root folder node network identifier **214** to an Object Linking and Embedding module (not shown) which invokes the network shell module **302**. The Object Linking and Embedding module (version 2.0) is defined by Microsoft Corporation and is well known in the art and is further described in *OLE* 2 *Programmer's Reference Vol. I*, Microsoft Press, 1993, *OLE* 2 *Programmer's Reference Vol. II*, Microsoft Press, 1993 and Brockschmidt, *Inside OLE* 2, Microsoft Press, 1994 which are hereby incorporated by reference. In response to the network identifier **214**, the Object Linking and Embedding module loads the network shell module **302**.

The network shell module **302** (hereinafter referred to as the network shell **302**) controls the communications between the computer shell **300** and one or more navigator modules **304**. As explained in more detail below, the network shell **302** preferably exists in a dynamic link library. The network shell **302** identifies the appropriate navigator module **304**, invokes the identified navigator module **304** and directs the navigator module **304** to perform specific tasks.

In addition, the network shell **302** converts nodal data received from the on-line network **100** into a format recognizable by the computer shell **300**. Furthermore, the network shell **302** locates and invokes executable programs when the user selects a leaf node **206** in the on-line network **100**.

As illustrated in FIG. **5**, the network shell **302** of the preferred embodiment acts as an extension of the Win 95 explorer. Thus, in one embodiment, the network shell **302** obtains the on-line nodal information necessary to present a hierarchial view of the on-line network in the left pane **402** and the contents of a selected folder node **204** in the right pane **404**. For example, in FIG. **5** the left pane **402** indicates that a user has selected the on-line network root folder node **204***a* (the folder node is highlighted in the left pane **402**). In the right pane **404**, the central navigator module **304***a*, as described in more detail below, displays the contents of the on-line network root folder node **204***a*.

The left pane **402** contains a hierarchical map of the user's location in the on-line network. In this example, the left pane **402** shows that the root folder node **204***a* contains three children folder nodes—a categories folder node **204***g*, a member assistance folder node **204***e*, and a favorite places folder node **204***f*. Further, the network shell **302** contains a similar command menu **500**.

Because the network shell **302** provides a graphical interface similar to the computer shell **300**, a user who is familiar with the computer shell **300** does not need to spend time learning a new interface. The network shell **302** of the present invention also allows a user to easily browse and explore the on-line network **100** with the hierarchical map provided in the left pane window **402**.

The next module of the present invention includes one or more navigator modules **304** (hereinafter referred to as navigators **304**). In the presently preferred embodiment, the on-line network access system contains a central navigator **304***a*, a directory service navigator **304***b* and a bulletin board navigator **304***c*. FIGS. **3**, and **5–10**, illustrate different embodiments of the central navigator **304***a*, the directory service navigator **304***b* and the bulletin board navigator **304***c*.

A navigator **304** is the software which (1) provides a user interface and (2) communicates with a data source such as the on-line network **100**. Thus, a navigator **304** is the software which displays certain menu commands or toolbars, certain kinds of icon formats, etc. In addition that navigator **304** communicates with a data source to obtain information such as nodal information from the on-line network **100**. Because many types of user interfaces currently exist, the present invention provides a unique architecture which allows different navigators **304** on an on-line network **100** to display different user interfaces.

Referring to FIG. **5**, the image created in the right pane **404** of the network shell **302** was created with the central navigator **304***a*. In this example, the central navigator **304***a* displays a home page for users of the on-line network **100**.

This home page is very simple and allows the user to begin browsing the on-line network **100** by selecting one of five different icon buttons **502**.

Referring now to FIG. **6**, another embodiment of the network shell **302** replaces the two-pane window with a single pane window **600** which does not display the hierarchical location of user in the on-line network. Rather, than showing the hierarchical structure of the network, the single pane window **600** only displays the images generated by the central navigator **304***a*.

If the user selects the categories icon button **502**, the user moves to the categories folder node **204***g*. In this example, the categories folder node **204***g* exists in the directory service namespace **202***b*. As explained below, the network shell **302** identifies that the categories folder node **204***g* exists in the directory service namespace **202***b* and consequently invokes the directory service navigator **304***b*. The directory service navigator **304***b* then creates the images which comprise the directory service user interface.

Referring to FIG. **7**, the user interface created by the network shell **302** and the directory service navigator **304***b* is shown. In the left pane **402**, the content map shows that the user has selected the categories folder node **204***g* (the categories folder node **204***g* is highlighted). In the right pane **404**, the directory service navigator **304***b* displays the contents of the categories folder node **204***g* as children folders **700**. Thus the directory service navigator **304***b* tailors the display of on-line service nodes to present a user interface which allows a user to easily browse the content of the on-line network **100**.

Referring now to FIG. **8**, in another embodiment, the network shell **302** replaces the two-pane window with a single pane window **800** which does not display the hierarchical location of the user in the on-line network. Rather, than showing the hierarchical structure of the on-line network **100**, the single pane window **800** only displays the images created by the directory service navigator **304***b*. In this example, the directory service navigator **304***b* displays the children nodes of the category folder node **204** as children folders **700** which a user can select to obtain additional information.

Referring to FIG. **9**, the user interface created by the network shell **302** and the bulletin board navigator **304***c* is shown. In this example, the content map in the left pane **402** shows that the user has selected the gardening bulletin board junction node **208**. As the hierarchy map shows, the path to the gardening bulletin board starts at the root folder node **204***a*, proceeds to the categories folder node **204***g*, the home and family folder node **204***i*, the gardening folder node **204***j* and the gardening bulletin board junction point node **208**.

In this example, the gardening bulletin board **204***c* exists in the bulletin board namespace **202***a*. As discussed in more detail below, the network shell **302** identifies that the garden bulletin board **204***c* exists in the bulletin board namespace **202***a* and consequently invokes the bulletin board navigator **304***c*. The bulletin board navigator **304** creates the images in the right pane **404** which comprise the bulletin board service user interface.

For example, the gardening bulletin board **204***c* contains a number of leaf nodes **206** relating to certain topics. In this example, the gardening bulletin board contains the shade loving plants leaf node **206***b*, the japanese beetles leaf node **206***c* and the cats in the garden leaf node **206***a*, etc. The bulletin board navigator **304***c*, however, displays the topics and comments about specific topics in a different format than the central navigator **304***a* or the directory service navigator **304***b*.

In this example, the bulletin board navigator **304***c* shows bold arrows **900** next to the comments that a user has not viewed. If a user has viewed a topic, the bulletin board navigator **304***c* removes the bolded arrow **900**. In this example, the user has read the cats in the garden leaf node **206***a*. Further, responses **902** to a particular topic are shown indented. In addition, the bulletin board navigator **304***c* displays a tool bar **904** which shows the subject **906** of a message and the author **908** of a message. Thus, the bulletin board navigator **304***c* tailors the user interface to display a format which optimizes the viewing of bulletin board messages.

Referring now to FIG. **10**, in another embodiment, the network shell **302** replaces the two-pane window with a single pane window **1000** which does not display the hierarchical location of user in the on-line network **100**. Rather, than showing the hierarchical structure of the on-line network **100**, the window simply displays the images created by the bulletin board service navigator **304***c*. In this example, the bulletin board service navigator **304***c* highlights the japanese beetles leaf node **206***c* and indents the response **902**. The tool bar **904** containing the subject **906**, the author **908**, the size **1004** and the date **1006** of a message is also shown.

The use of different navigators **304** allows a service provider to customize a particular navigator **304** for the type of service provided. Thus, when a user accesses the directory service namespace **202***b* or the bulletin board namespace **202***a*, the user sees the navigator **304** for the nodes in the selected service namespace **202**. In the preferred embodiment of the present invention, the network shell **302** automatically identifies the proper navigator **304** when a user selects the node of a particular service namespace **202**.

In addition, it is contemplated that future service providers may wish to provide custom navigators **304** for their assigned service namespaces **202** (their portion of the on-line network **100**). For example, suppose a product support group has used a support program with a particular user interface for several years. Users of the support program are accustomed to the menus and toolbars in the support program.

When the product support group desires to provide a product support service on the on-line network **100**, the on-line network **100** assigns a particular service namespace **202** to the product support group. The product support group can then use the present invention to provide users with a navigator **304** which contains the user interface that users of the product support service are accustomed to.

Referring now to FIG. **11**, the data structure created by the on-line network access system of the preferred embodiment of the present invention is shown. The data structure exists in the memory of the local computer **102** and includes a computer shell object **1100**, multiple window objects **1102**, multiple shell folder objects **1104**, a network cache object **1106**, multiple shell view objects **1110**, multiple node pointer objects **1108**, multiple view window objects **1112**, the central navigator **304***a*, the directory service navigator **304***b* and the bulletin board navigator **304***c*. While the following description describes the present invention in object-oriented terminology, a person of ordinary skill in the art will appreciate that other programming techniques can be used such as programming techniques that use defined structures, arrays, procedure calls and subroutines.

In the present invention, an object is a data structure which contains data and a set of accompanying functions which manipulate the data. A function (also called a method) is a set of programmed instructions which direct the com-

puter hardware to perform a desired action. An object communicates with another object by "calling" a function in the object. This typically takes the form of a procedure call which specifies a particular function and passes data to the object containing the function. The functions that exist in an object are often called application programming interfaces or API'S.

In the preferred embodiment of the present invention, the computer shell **300** is represented by the computer shell object **1100** and multiple window objects **1102**. The computer shell object **1100** contains the data and functions which implement the computer shell **300**. In the preferred embodiment, the computer shell object **1100** and the window objects **1102** are created by the Win 95 Explorer. A window object **1102** contains the data and functions for displaying a window on a user's computer screen.

The preferred embodiment of the present invention expands the Win 95 Explorer to access the on-line network **100** via the network shell **302**. As explained in more detail below, the Win 95 Explorer has been expanded to include the network identifier **214** of the root folder node **204***a*, and the software instructions that call the network shell **302** functions. One of ordinary skill in the art will also appreciate that other commercially available computer shells can be adapted to include a reference to the network identifier **214** of the root folder node **204***a*, and the network shell function calls described below.

The network shell **302** is represented by multiple shell folder objects **1104**, multiple shell view objects **1110** and a network cache object **1106**. In the preferred embodiment, the shell folder object **1104** is called the IShellFolder object. The IShellFolder acronym stands for an "Instance of the Shell Folder object" and is hereinafter referred to as the shell folder object **1104**. Each shell folder object **1104** corresponds to a folder node **204** accessed by the user of the present invention. Each shell view object **1110** corresponds to a folder node **204** displayed by the present invention.

The network cache object **1106** is a large memory array which contains a copy of up to one thousand node pointer objects **1108** created during an on-line session. In the preferred embodiment, once the network cache object **1106** contains 1,000 node pointer objects **1108**, it uses a least recently used algorithm so as not to exceed the 1,000 maximum limit. When the 1,000 limit is exceeded, the network cache object **1106** deletes ten of the least recently used node pointer objects **1108** and keeps the 990 most recently used node pointer objects **1108**.

The navigators **304***a*, **304***b* and **304***c* are referenced by the node pointer objects **1108** and the view window objects **1112**. Each node pointer object **1108** references a particular node on the on-line network **100**. The present invention creates a node pointer object **1108** each time the user selects a new node in the on-line network **100**. The present invention creates a view window object **1110** each time a node is displayed by the local computer **102**. In addition, each node pointer object **1108**, and each view window object **1112** references a particular navigator **304**.

It should be understood that FIG. **11** only illustrates a snapshot of the data structure at a particular point in time. Thus, FIG. **11** illustrates the data structure where a user has used three different navigators **304***a*, **304***b* and **304***c* to view three nodes on the on-line network **100**. As the user views additional nodes in the on-line network **100**, the data structure expands to contain additional shell folder objects **1104**, node pointer objects **1108**, shell view objects **1110** and view window objects **1112**. Further, as different navigators **304** are used, the present invention will load the additional navigators **304** into the data structure from the hard disk in the local computer **102**.

Referring to FIG. **12**, a detailed block diagram of a shell folder object **1104**, a node pointer object **1108**, a shell view object **1110**, a view window object **1112** and a navigator **304** is shown. Each shell folder object **1104** contains a network identifier **214** for a particular node in the on-line network **100**, a network path **1200**, and a set of network shell functions **1206**. The network path **1200**, as described in more detail below contains the path of nodes to a particular location in the on-line network **100**. The network shell functions that implement the preferred embodiment include the create node function **1208**, the GetUserInterface function **1210**, the execute leaf function **1212** and the DoDragDrop function **1214**.

Each node pointer object **1108** references a node on the on-line network **100** and contains the set of node properties **210** such as the node's name **212**, the network identifier **214**, icon identifier **216**, and flags **218**. As discussed above, the network identifier **214** is a 128-bit number which contains the application identifier **220**, the directory entry identifier **222** and the service group identifier **224**. The icon identifier **216** identifies the icon image or bit-map associated with the node. The flags **218** identify whether the node is a folder node **204**, a leaf node **206** or a junction point node **208**.

The function table **1220** references a set of navigation functions **1222** in a particular navigator **304**. The navigation functions required to implement the present invention include a GetNodePointer function **1224** (in the preferred embodiment the GetNodePointer function **1224** is actually called the GETPMTN function **1224** but is herein referred to as the GetNodePointer function **1224**), a GetViewWndObject function **1226**, a GetProperties function **1228**, a GetChildren function **1230** and an Execute function **1232**. As shown in FIG. **12**, the function table **1220** in the node pointer object **1108** contains pointers which reference the navigation functions.

As will be explained in more detail below, each navigator **304** uses standardized names for particular navigation functions. This allows the shell folder objects **1104** to call a particular navigation function without knowing which navigator **304** will execute the function. For example, to get the children nodes of a folder node **204**, all of the navigators **304** contain a GetChildren function **1230**. Thus, the shell folder object calls the GetChildren function **1230** to direct all the navigators **304** to obtain the children nodes of a folder node **204**.

Each navigator **304**, however, implements its own software instructions to obtain the children nodes. If a particular navigator **304** displays the children nodes in a particular format, the GetChildren function **1230** for that navigator **304** contains the different program instructions to display the desired format. Thus, the shell folder object **1104** calls standardized function names that the navigators **304** implement differently. Thus, as new navigators **304** are added, the shell folder objects **1104** still use the standardized names that the new navigators **304** perform in a different ways to provide that navigator's **304** unique user interface.

The function table **1220** in the node pointer object **1108** links the standardized navigation functions to a particular navigator **304**. As explained in more detail below, each node on the on-line network **100** is assigned to a particular navigator **304**. When the present invention creates a new node pointer object **1108**, the node pointer object **1108** references its assigned navigator **304**. For example, in the preferred embodiment of the present invention, each node pointer object **1108** contains a function table **1220** which

references the navigation functions in the central navigator **304***a*, the service directory navigator **304***b* or the bulletin board navigator **304***c*. In the preferred embodiment, the navigation functions **1222** are called by specifying their particular locations in the function table **1220**.

Furthermore, these navigator functions **1222** are capable of accessing different data sources. In the preferred embodiment, the navigators **304** access the on-line network **100** and obtain nodal information from the on-line network **100**. In other embodiments, a navigator **304** can assess a different data source such as a file on a user's hard disk, a private database or even a different on-line network **100**. For example, the central navigator **304***a* of the present invention obtains the bit-mapped images displayed in FIGS. **5** and **6** from data stored in the user's hard disk. The central navigator **304***a* does not need to download these images every time the user wishes to access the on-line network.

In addition, since the navigators **304** of the present invention have the flexibility of accessing other data sources, a service provider can develop a navigator **304** that accesses other data sources for information such as information obtained by connecting to a private data base or information that exists on a user's local area network. In other embodiments, the navigators **304** can access other on-line networks such as the internet. Thus, the navigators **304** provide the flexibility of accessing information content that exists in other data sources including other on-line networks.

The central navigator **304***a*, the service directory navigator **304***b*, and the bulletin board navigator **304***c* are dynamic link libraries which contain their own versions of the GetNodePointer function **1224**, the GetViewWndObject function **1226**, the GetProperties function **1228**, the GetChildren function **1230** and the Execute function **1232**. Accordingly, each navigator **304**, implements these functions to display the images shown in FIGS. **5–10**. Thus, these navigator functions **1222** contain the software instructions which provide the different user interfaces supported by the on-line network **100**.

Each shell view object **1110** contains a node pointer **1240** and an AddWindows function **1242**. The node pointer **1240** references a node pointer object **1108**. In addition, each shell view object **1110** references one of the view window objects **1112**. As explained below, the shell view object **1110** interacts with a view window object **1112** to display the contents of a selected node.

Each view window object contains a DisplayWindow function **1244** that is used to assess a particular navigator **304**. As is explained in more detail below, the AddWindows function **1242** in the shell view object **1110** calls the DisplayWindow function **1244** in the view window object **1112** to display the right pane **404** in the window **400**. The DisplayWindow function **1244** then executes the instructions that direct the referenced navigator **304** to display the images in the right pane **404** existing in the window **400**.

Referring now to FIG. **13**, the data format which represents an on-line network node in the preferred embodiment of the present invention is shown. Because computer shells **300** often require specific data formats, the present invention formats the data contained in an on-line network node to comply with the data format of the computer shell **300**. Thus, in order to display information about an on-line network node in the computer shell **300**, the network shell **302** encapsulates the network identifier **214** associated with the on-line network node into a computer shell **300** compatible data structure.

In the preferred embodiment, the network shell **302** formats the network identifier **214** to comply with the data format of the Win 95 Explorer. In particular, the network shell **302** adds a length header **1300** to the network identifier **214**. The length header **1300** is 16 bits (two bytes) long and contains the size of the 128-bit network identifier **214**. Since many software compilers require eight byte data boundaries, the length header **1300** of the preferred embodiment is eight bytes with six unused bytes. In addition, the preferred embodiment adds a validator **1302** which represents the decimal number 112,393. The validator **1302** is used for debugging purposes and indicates that the data structure relates to a node on the on-line network **100**.

Referring to FIG. **14**, the present invention represents an example of the format of the network path **1200** located in each shell folder object **1104**. The network path **1200** in this example, is the path to the categories folder node **204***g*. The network path **1200** includes the length header **1300**, the network identifier **214** and the validator **1302** for the on-line network root folder node **204***a* and the length header **1300**, the network identifier **214** and the validator **1302** for the categories folder node **204***g*. The end of the network path **1200** is signaled by a null data segment **1304** which is set to zero.

Referring now to FIG. **15**, a high level flow chart which outlines the execution states of the present invention is shown. Upon activation of a user's computer, in start state **1500**, the computer loads the operating system and proceeds to state **1502**. In state **1502**, the local computer **102** displays the operating system user interface or computer shell **300**. In the preferred embodiment, the user views the Win 95 Explorer. While in state **1502**, a user can browse his local hard disk and view the programs, files and documents stored on his local hard disk.

In response to a user's selection of the on-line network **100**, the computer shell **300** proceeds to state **1504**. For example, the computer shell **300** proceeds to state **1504** when the user selects an on-line network icon or chooses an on-line network menu command in the computer shell **300**. In state **1504**, the computer shell passes the network identifier **214** for the root folder node **204***a* to the Object Linking and Embedding module in the operating system of the local computer **102**. Using the network identifier **214**, the Object Linking and Embedding module invokes the network shell **302** and creates the shell folder object **1104** and the network cache object **1106**.

Proceeding to state **1506** the shell folder object **1104** determines which navigator **304** corresponds to the root folder node **204***a*. As discussed in more detail below, the shell folder object **1104** determines that the central navigator **304***a* is assigned to the root folder node **204***a*. After identifying the central navigator **304***a*, the shell folder object **11034** invokes the central navigator **304***a* and directs the central navigator **304***a* to obtain information about the root folder node **204***a*. While in state **1506**, the central navigator **304***a* then creates a node pointer object **1108** which references the root folder node **204***a*. In addition, the central navigator **304***a* creates the function table **1220** in the node pointer object **1108** which references the navigation routines in the central navigator **304***a*.

Proceeding to state **1508**, the present invention displays the selected node on the display of the local computer **102**. While in state **1508**, the computer shell object **1100** directs the shell folder object **1104** to create the shell view object **1110** and the view window object **1112**. The shell view object **1110** and the view window object **1112** then direct the **304** to retrieve the set of node properties **210** associated with the root folder node **204***a* and to display the properties in the right pane **404** of the window object **1102**.

For example, as shown in FIG. **5**, when displaying the set of node properties **210** associated with the root folder node **204***a*, the computer shell object **1100** displays the content map in the left pane **402** and the central navigator **304***a* displays the contents of the root folder node **204***a* in the right pane **404**. In this example, the shell view object **1110** and the view window object **1112** direct the central navigator **304***a* displays the contents of the root folder node **204***a* as a number of icon buttons **502**.

Proceeding to state **1510**, the navigator **304** waits for the user to input a request. For example, when viewing the root folder node **204***a*, the user may choose to select one of the icon buttons **502** or exit the on-line network **100**. If the user chooses to exit the on-line network **100**, the navigator proceeds back to state **1502**. While in state **1510**, the navigator **304** communicates with the network shell **302** when the user desires to return to the computer shell object **1100** and stop communicating with the on-line network **100**. In the preferred embodiment, the computer shell object **1100** ends communications with the on-line network **100** and deletes any window objects **1102** associated with the on-line network **100**, the network cache object **1106**, the shell folder objects **1104**, the node pointer objects **1108**, the shell view object **1110**, the view window object **1112** and the navigators **304** which exist in the data structure.

If, instead of exiting the on-line network **100**, the user selects another node while in state **1510**, the present invention determines whether the selected node is a folder node **204**, a leaf node **206**, or junction point node **208**. For example, if the user selects the categories icon button **502** displayed by the central navigator **304***a*, the central navigator **304***a* determines whether the categories node is a folder node **204** or a leaf node **206**. In this example, the central navigator **304***a* determines the node type by retrieving the set of node properties **210** associated with the selected node. In the set of properties **201** exist the flags **218** which contain a folder node flag, a leaf node flag and a junction node flag. If the folder flag **218** is set, the node is a folder node **204**. If the leaf flag **218** is set, the node is a leaf node **206**. If the junction node flag **218** is set, the node is a junction node.

As explained above, a folder node **204** references other nodes. Thus, if the user selects a folder node **204**, the navigator notifies the shell folder object **1104** that the user has selected a folder node and proceeds back to state **1504**. As explained above, in state **1504**, a shell folder object **1104** is created for the selected folder node **204**.

If the user selects a leaf node **206**, the navigator **304** notifies the shell folder object **1104** that the user has selected a leaf node **206** and proceeds to state **1512**. A leaf node **206** does not reference other nodes and contains such things as executable programs and data files. In state **1512**, The shell folder object **1104** locates an executable program associated with the leaf node **206** and launches the executable program. For example, when the user selects a chat room, the shell folder object **1104** locates and invokes a client chat application.

Each of the states in the high-level flow chart of FIG. **15** will now be discussed in detail. Referring now to FIG. **16**, a detailed flow chart of the operation of the computer shell object **1100** in state **1502** is shown. As explained above, Win 95 Explorer begins in start state **1600** and proceeds to state **1602**.

While in state **1602**, the computer shell object **1100** uses techniques known in the art to display a windows oriented computer user interface. In particular, the computer shell object **1100** uses techniques known to one of ordinary skill in the art to create objects and display the computer's file system as a hierarchical structure of folders, data files and programs.

Proceeding to state **1604**, the computer shell object **1100** monitors the user's input commands. Monitoring the user's input commands is accomplished via a variety of techniques known to one of ordinary skill in the art such as monitoring the keyboard, a mouse input device, a voice input device, etc. Once a user inputs a command, the computer shell object **1100** proceeds to state **1606**, where the computer shell object **1100** checks to see if the user has selected the on-line network **100**. If not, the computer shell object **1100** proceeds to state **1608** where the computer shell object **1100** performs the user's input command in the user's local computer.

If the user, however, selects the on-line network **100**, the computer shell object **1100** proceeds back to state **1504** via return state **1610**. Referring to the flow charts illustrated in FIGS. **15** and **17**, the computer shell object **1100** creates the shell folder object **1104** and the network cache object **1106** in state **1504**. Beginning in a start state **1700**, the computer shell object **1100** proceeds to state **1702**. In state **1702**, the computer shell object **1100** obtains the on-line network globally unique identifier. In the preferred embodiment of the present invention, the on-line network is identified with a globally unique identifier which has been predefined by the creator of the on-line network.

This globally unique identifier (also called a GUID) is a 128 bit value which is stored in the program of the computer shell object **1100**. In the preferred embodiment, the on-line network globally unique identifier is the network identifier **214** for the root folder node **204***a* in the on-line network **100**. When a user selects the icon which represents the on-line network **100**, or inputs a command requesting the on-line network **100**, the computer shell object **1100** uses the network identifier **214** of the root folder node **204***a* to create the shell folder object **1104**.

Proceeding to state **1704**, the computer shell object **1100** loads the network shell dynamic link library into the memory of the local computer **102** and calls the CoCreateInstance function in the Object Linking and Embedding module. The CoCreateInstance function loads the network shell dynamic link library into the computer's memory. The CoCreateInstance function is well known in the art, and is described in *OLE* 2 *Programmer's Reference Vol. I*, Microsoft Press, 1993, pp. 256 and in *OLE* 2 *Programmer's Reference Vol. II*, Microsoft Press, 1993, pp. 56–62, and Brockschmidt, *Inside OLE* 2, Microsoft Press, 1994, pp. 149–152.

While in state **1704**, the OLE CoCreateInstance function uses the network identifier **214** of the root folder node **204***a* as an index into an OLE table which associates the network identifier **214** with the network shell dynamic link library. The OLE table is predefined and is loaded into the user's computer when the user installs the operating system.

The OLE table contains the location of the network shell dynamic link library in the user's computer hard disk. The CoCreateInstance function uses the location of the network shell dynamic link library from the OLE table to load the network shell dynamic link library into the computer's memory.

When loading the network shell dynamic link library, the setup routines in the network shell dynamic link library create the network cache object **1106**. The network cache object **1106** is a block of memory which holds the node pointer objects **1108** which, as discussed in more detail below, are created to reference the network nodes. The network cache object **1106** holds up to 1,000 node pointer objects **1108** created during a particular logon session. When more than 1,000 node pointer objects **1108** are accessed during a particular logon session, the network cache object

1106 deletes ten of the least recently made copies of the node pointer objects 1108 from its cache memory.

The network cache object 1106 of the present invention only lasts while the user is connected to the on-line network 100. As explained below, if the user exits the on-line network 100, the network cache object 1106 and its contents are deleted. Thus, a new network cache object 1106 is created each time the user accesses the on-line network 100.

Proceeding to state 1706, the CoCreateInstance routine creates the shell folder object 1104. While in state 1706, the CoCreateInstance routine stores the network path 1200 in the newly created shell folder object 1104. After creating the shell folder object 1104, the CoCreateInstance function then proceeds to return state 1708.

Referring to FIG. 15, the shell folder object 1104 creates a node pointer object 1108 in state 1506. In the preferred embodiment, the computer shell object 1100 calls the create node function 1208 in the shell folder object 1104. The create node function 1208 requires communications among the computer shell object 1100, the shell folder object 1104, the node pointer object 1108 and a particular navigator 304.

In the preferred embodiment, the create node function 1208 is called the HrGetPMtn function which is a global routine in the network shell dynamic link library. The HrGetPMtn acronym means "get a pointer to the Microsoft Tree Node Object" and is hereinafter referred to as the create node function 1208. The computer shell object 1100 contains a program instruction which "calls" the create node function 1208. The program instruction in the computer shell object 1100 which "calls" the create node function 1208 that exists in the network shell 302. When calling the create node function 1208, the computer shell object 1100 passes the network identifier 214 of the on-line network node.

For example, for the root folder node 204*a*, the computer shell object 1100 calls the create node function 1208 in the network shell 302 and passes the network identifier 214 for the root folder node 204*a*. As explained above, the network identifier 214 for the root folder node 204*a* is stored in the programmed instructions of the computer shell object 1100.

A detailed flow chart of the create node function 1208 is shown in FIG. 18. The create node function begins in a start state 1800 and proceeds to state 1802. In state 1802, the create node function 1208 uses the network identifier 214 to determine whether the node pointer object 1108 for a particular node already exists in the network cache object 1106. As explained in more detail below, if a node pointer object 1108 exists in the network cache object 1106 the create node function 1208 proceeds to state 1814. In state 1814, the create node function 1208 links the node pointer object to the shell folder object 1104 and proceeds to return state 1816.

If the network cache object does not contain the node pointer object 1108, the create node function 1208 proceeds to state 1804. In this example, the network cache object 1106 is empty since the computer shell object 1100 just created the network cache object 1106. While in state 1804, the create node function 1208 extracts the application identifier 220 from the network identifier 214. In the preferred embodiment, the application identifier 220 is the first 32 bits of the network identifier 214 and is defined to be the number three.

Proceeding to state 1806, the create node function 1208 locates the navigator 304 which corresponds to the application identifier. Specifically, the create node function 1208 uses the application identifier 220 as an index into a navigator table 1204. The navigator table 1204 exists in the shell folder object 1104 and is updated every time a new navigator 304 is installed on the user's computer. The navigator table 1204 is a lookup table which contains the location of the navigator 304 which corresponds to the application identifier 220.

For example, the create node function 1208 uses the application identifier 220 (which is three as shown in Table 1) of the root folder node 240*a*, to locate the third entry in the lookup table. The third entry in the lookup table then contains the file path to the location of the central navigator 304*a* on the user's computer hard disk. When the user installs a navigator, the navigator table 1204 references the location of the central navigator 304*a* on the user's hard disk.

Proceeding to state 1808, the create node function 1208 loads the navigator 304 referenced in the navigator table 1204. Preferably, the navigator 304 is a dynamic link library which provides the set of common navigation functions 1222. As explained above, in the preferred embodiment, each navigator 304 contains the navigation function names, but implments the function names with different software instructions. Once loaded into memory, this set of navigation functions 1222 implement the navigator's 304 unique interface. For the root folder node 204*a*, the create node function 1208 retrieves the central navigator 304*a* from the hard disk and loads it into memory.

Proceeding to state 1810, the create node function 1208 directs the navigator 304 to create the node pointer object 1108 by calling the GetNodePointer function 1224 in the navigator 304. Specifically, in this example, the create node function 1208 in the shell folder object 1104 contains a program instruction which calls the GetNodePointer function 1224 existing in the central navigator 304*a*. When the create node function 1208 calls the GetNodePointer function 1224, it passes the directory entry identifier 222 of the root folder node. As explained above, the directory entry identifier 222 is a 64-bit value which uniquely identifies each node in a particular service namespace 202.

Referring to FIG. 19, a detailed flow chart of the GetNodePointer function 1224 of state 1810 is shown. Beginning in a start state 1900, the GetNodePointer function 1224 proceeds to state 1902. In state 1902, the GetNode Pointer function 1224 uses object creation techniques known to one skilled in the art to create the node pointer object 1108. While in state 1904, the GetNodePointer function 1224 stores the directory entry identifier 222 in the newly created node pointer object 1108. In this example, the GetNodePointer function 1224 stores the directory entry identifier 222 for the root folder node 204*a* in the node pointer object 1108.

After creating the node pointer object, the GetNodePointer function 1224 proceeds to state 1904. In state 1904, the GetNodePointer function 1224 links the pointers in the function table 1220 to a particular navigator 304. For example, for the node pointer object 1108 which references the root folder node 204*a*, the central navigator 304*a* sets the pointers in the function table 1220 to reference the set of navigation functions 1222 in the central navigator 304*a*. This set of navigation functions 1222 is later used to obtain the properties of the root folder node 204*a*, the children of the nodes, etc.

Proceeding to state 1906, the GetNodePointer function 1224 establishes a connection with a data source such as the on-line network 100 and locates the node on the on-line network with the same directory entry identifier. As explained above, the navigators 304 can reference different data sources. Thus instead of accessing the on-line network,

a navigator **304** could use commonly known techniques to reference another data source such as local data base, or access some other on-line network such as the internet.

In this example, the central navigator **304** accesses the on-line network **100** to locate the root folder node **204***a*. The GetNodePointer function **1224** first compares its directory entry identifier **222** with the directory entry identifier **222** in the root folder node **204***a* of the on-line network **100**. Since, in this example, the two are identical, the GetNodePointer function **1224** immediately locates the root folder node **204***a*.

The GetNodePointer function **1224** then proceeds to return state **1908**. In return state **1908**, the GetNodePointer function **1224** in the navigator **304** returns control back to the create node function **1208** in the shell folder object **1104**.

Referring now to FIG. **18**, the create node function **1208** in the shell folder object **1104** then proceeds to state **1812**. In state **1812**, the create node function **1208** stores a copy of the newly created node pointer object **1108** in the network cache object **1106**. The create node function **1208** then proceeds to a return state **1816**.

Referring now to FIG. **15**, the shell folder object **1104** then proceeds to state **1508**. In state **1508**, the present invention displays the contents of a node on the user's computer monitor. While in state **1508**, the computer shell object **1100** creates the window object **1102** and displays the left pane **402** of window **400**. As described in more detail below, the computer shell object **1100** then directs the shell folder object **1104** to execute the functions that creates the right pane **404** of window **400**.

In particular, the computer shell object **1100** executes the GetUserInterface function **1210** which creates the shell view object **1110**. The shell view object **1110** then calls the GetViewWndObject function **1226** which creates the view window object **1112**. As described below, the shell view object **1110**, the view window object **1112**, and the navigator **304** then interact to display the contents of the on-line node referenced by the node pointer object **1108**.

Referring now to FIG. **20**, a detailed flow chart of the state **1508** is shown. Beginning in a start state **2000**, the computer shell object **1100** proceeds to state **2002**. In state **2002**, the computer shell object **1100** uses techniques known to one of ordinary skill in the art to create an object such as the window object **1102** which displays a window on the user's local computer **102**. After creating the window, the computer shell object **1100** also displays the content map in the left pane **402** of window **400**. The computer shell object **1100** uses the network path **1200** to display the data paths to nodes in the on-line network **100**.

Proceeding to state **2004**, the computer shell object **1100** directs the shell folder object **1104** to create the shell view object **1110**. In the preferred embodiment, the computer shell object **1100** calls the GetUserInterface function **1210** that exists in the shell folder object **1104**. When the computer shell object **1100** calls the GetUserInterface function **1210**, the computer shell object **1100** passes the node pointer **1240**. The node pointer **1240** that references the node pointer object **1108**. Using object creation skills known to one of ordinary skill in the art, the GetUserInterface function **1210** creates the shell view object **1110** and stores the node pointer **1240** in the newly created shell view object **1110**.

Proceeding to state **2006**, the GetUserInterface function **1210** directs the shell view object **1110** to create the view window object **1112**. In the preferred embodiment, the GetUserInterface function **1210** directs the shell view object to call the GetViewWndObject function **1226** in the node pointer object **1108**. When calling the GetViewWndObject function **1226**, the shell view object **1110** uses the node pointer **1240** to identify the referenced node pointer object **1108**. The GetViewWndObject acronym stands for "get the view window object."

As explained above, the node pointer object **1108** contains a function table **1220** which points to the set of standardized navigation functions **1222** in the referenced navigator **304**. The referenced navigator **304** then executes its implementation of the GetViewWndObject function **1226** which creates the view window object **1112**. This allows the shell view object **1110** to the call a standardized navigation function that each navigator **304** implements in a different manner to create its own unique user interface.

In this example, the shell view object **1110** calls the GetViewWndObject function **1226** that the node pointer object references in the central navigator **304***a*. The central navigator **304***a* then executes its implementation of the GetViewWndObject function **1226**. The GetViewWndObject function **1226** in the central navigator **304***a* creates the view window object **1112**.

After creating the view window object in state **2006**, the GetViewWndObject function **1226** in the navigator **304** returns control back to the shell view object **1110** (the shell view object originally called the GetViewwndObject function **1226**). The shell view object **1110** then returns control back to the shell folder object **1104**. The shell folder object completes execution of the GetUserInterface function **1210** and returns control back to the computer shell object **1100**.

Proceeding to state **2008**, the computer shell object **1100** directs the shell view object **1110** to display the right pane **404** of the window **400**. In state **2008**, the computer shell object **1100** calls the AddWindows function **1242** in the shell view object **1110**. The AddWindows function **1242** in turn calls the display windows function **1244** in the view window object **1112**. The display windows function **1244** then obtains and displays the contents of the selected node in the right pane **404** of the window **400**.

For the selected root folder node **204***a*, the display windows function in the view window object **1112** obtains the root folder node's **204***a* set of node properties **210** and displays the button icons **502** illustrated in FIG. **5**. Proceeding to return state **2010**, the display windows function **1244** returns control back to the shell view object **1110** (the shell view object **1110** originally called the display windows function **1244**). The shell view object **1110** then completes execution of the AddWindows function **1242** and returns control back to the computer shell object **1100** (the computer shell object **1100** originally called the AddWindows function **1242**).

Because the present invention uses standardized function calls which reference different navigators **304**, developers implement new navigators **304** which display their own user interfaces. To do so, the developer of a new navigator **304** uses the standardized GetViewWndObject function **1226** name, but programs different instructions to display the new user interface.

a. Selection Of A Folder Node

Referring now to FIG. **15**, the present invention proceeds to state **1510** and waits for the user's input. A detailed flow chart of state **1510** is shown in FIG. **21**. Beginning in a state **2100**, the present invention proceeds to state **2102**. In state **2102** the user views the window object **1102** which displays information about the selected node. In this example, the user views the window object **1102** which displays the root folder node **204***a*. When the user selects one of the button icons **502** in state **1510**, the present invention proceeds to state **2104**.

In state **2104**, the navigator **304** communicates to the shell folder object **1104** which the user has selected a particular icon or menu command. In this example, each icon represents another node in the on-line network **100** and has a network identifier **214** associated with it. Once the user selects another node in the on-line network **100**, the shell folder object **1104** must create a new node pointer object **1108** for the selected node. The shell folder object **1104** creates the new node pointer object **1108** using the functions described above.

While in state **2104**, the shell folder object **1104** creates a new node pointer object **1108**. The shell folder object **1104** uses the new node pointer object **1108** to obtain the flags **218** associated with the selected node. With the flags **218**, the shell folder object determines whether the selected node is a folder node **204** or a leaf node **206**. In this example, the user selects the categories folder node **204***g*. In state **2104**, the central navigator **304** directs the shell folder object **1104** to create a new categories node **204***g* pointer object **1108** by calling the create node function **1208**. Thus, the central navigator uses the same create node function **1208** as discussed above.

Executing the same steps illustrated in FIGS. **18** and **19**, the create node function **1208** uses the application identifier **220** of the categories node **204***g* to create a new node pointer object **1108**. In this example, the categories node **204***g* in the on-line network **100** is part of the directory service namespace **202***b*. In the preferred embodiment, the application identifier **220** for the directory service navigator is the number one.

With the application identifier **220**, the create node function **1208** locates the directory service navigator **304***b* and loads the directory service navigator **304***b* into the computer's memory. The directory service navigator **304** then creates the categories node pointer object **1108** and sets the pointers in the function table **1220**. The pointers in the function table **1220** reference the set of navigation functions **1222** in the directory service navigator **304***b*. In addition, a copy of the categories node pointer object **1108** is stored in the network cache object **1106**. Once complete, the create node function returns control back to the central navigator in state **2106**.

Proceeding to state **2106**, central navigator directs the shell folder object **1104** to determine whether the categories folder node **204***g* is a folder node **204** or a leaf node **206** by analyzing the flags **218**. In this example, the folder flags **218** indicates that the categories folder node **204***g* is a folder node **204**.

Since the categories folder node **204***g* is a folder node **204**, the present invention creates a network path **1200** which contains the "path" or list of nodes to the categories folder node **204***g* in state **2108**. The network path **1200** to the categories folder node **204***g* is shown in FIG. **14**. To create the network path **1200**, the shell folder object **1104** adds the length header **1300**, the network identifier **214** and the validator **1302** of the categories folder node **204***g* to the network path **1200** stored in the shell folder object **1104**. In addition, the shell folder object **1104** adds the null data segment **1304** to signal the end of the network path **1200**. In this example, the network path **1200** stored in the shell folder object **1104** contains the length header **1300**, network identifier **214** and validator **1302** associated with the root folder node **204***a*.

Proceeding to state **2110**, the shell folder object **1104** calls a browser function which exists in the computer shell object **1100**. When the shell folder object **1104** calls the browser function, it passes the network path **1200** created in state **2108**. The browser function in the computer shell object **1100** traverses the network path **1200** until it comes to the last node in the network path **1200** (in this example, the categories folder node **204***g*). The browser function in the computer shell **300** then extracts the network identifier **214** for the last node in the network path **1200** and proceeds to state **1504** where the present invention creates a new shell folder object for the selected categories folder node **204***g*.

After creating the new shell folder object **1104** with the CoCreateInstance function in state **1504** as described above, the computer shell **300** proceeds to state **1506** where it again calls the create node function **1208**. In this example, the create node function **1208** retrieves the categories node pointer object **1108** from the network cache object **1106** and links the categories node pointer object **1108** to the new shell folder object **1104**. The categories node pointer object **1108** exists in the network cache object **1106**, since the categories node pointer object **1108** was previously created to determine whether the categories node was a folder node **204** or a leaf node **206**.

Proceeding to state **1508**, the computer shell object **1100** directs the present invention to display the contents of the categories folder node **204***g* of the monitor of the local computer **102**. As explained above, the computer shell object **1100** creates the window object **1102** and displays the left pane **402** of window **400**. The computer shell object **1100** then directs the shell folder object **1104** to create the shell view object **1110** and the view window object **1112** that display the right pane **404** in the window object **1102**.

b. Selection Of A Leaf Node

If, in state **1510**, the user selects a leaf node **206**, the present invention, as described below invokes a client application associated with the leaf node **206**. Referring to FIG. **21**, the flow chart for state **1510** shows that the present invention monitors the user's input in state **2102**, if a user selects a leaf node **206** in state **2102**, the present invention creates a new node pointer object **1108** in state **2104** and obtains the leaf flag **218**. In state **2106**, the leaf flag **218** is set and the present invention proceeds to state **1512**.

In state **1512**, the present invention executes the application associated with the leaf node. For example, if the leaf node is a chat room, the present invention executes the client chat application. While in state **1512**, the present invention starts a new process and launches the client application associated with the leaf node **206**. Referring now to FIG. **22**, a detailed block diagram of state **2112** is shown. The shell folder object **1104** begins in a start state **2200** and proceeds to state **2202**.

In state **2202**, the shell folder object **1104** runs the execute leaf function **1212** in the referenced navigator **304**. In the preferred embodiment, the execute leaf function **1212** is called the HRMOSExec function and is herein referred to as the execute leaf function **1212**. The execute leaf function **1212** uses the leaf node's **206** application identifier **220** to locate the executable file containing the client application in an application lookup table. For example, for a chat room, the execute leaf function **1212** uses the chat leaf node's **206** application identifier to locate the chat.exe executable for the client chat application.

Proceeding to state **2204**, the execute leaf function **1212** calls the Execute function **1232** in the node pointer object **1108**. The Execute function **1232** uses techniques known to one of ordinary skill in the art to start a new process in the local computer **102**. A process is the dynamic invocation of a program along with the system resources required for the program to run. For example, a process may have its own memory address space, its own communication ports, and

files, etc. After starting the new process, the Execute function **1232** returns control back to the shell folder object **1104**.

For example, if the leaf node **206** is a chat room, the execute leaf function launches the chat client application in the newly created process. After launching the desired client application, the Execute function **1212** then returns control back to the execute leaf function **1212** in state **2204**. Proceeding to state **2206**, the execute leaf function **1212** returns back to state **1510** via return state **2206**. In state **1510**, the present invention waits for the next user input command.

4. Shortcuts

The present invention also provides "shortcuts" which reside in a user's local computer. These shortcuts allow the user to reference particular locations in the on-line network and directly jump to that particular location when the user activates the shortcut. For example, a user may periodically wish to access a bulletin board on gardening. As explained in more detail below, the user selects the desired bulletin board icon and drags the icon to a folder in his local computer. The network shell then creates a shortcut and places the shortcut in the selected folder of the user's local computer.

Referring now to FIG. **23**, the user interface associated with the creation of a shortcut is shown. FIG. **23** contains the two-pane window **400** created by the Win 95 Explorer and a second window **2300** which displays the contents of a user's local file system. The hierarchy map in the left pane **402** shows that the user is in the gardening folder node **204***j*. The right pane **404** shows the contents of the gardening folder node **204***j* which contains the gardening bulletin board **204***c*. The second window **2300** shows the contents of a folder in the user's local file system. The contents include a documents folder, a letters folder a document named notes.doc and a shortcut **2302** to the gardening bulletin board **204***c*.

In this example, the user has viewed a variety of nodes in the on-line network **100** as discussed above in FIG. **15**. The user is currently in state **1508** and is viewing the contents of the gardening folder node **204***j* in the directory service namespace **202***b*. Accordingly, a gardening shell folder object **1104** and a gardening node pointer object **1108** exist in the data structure.

Referring now to FIG. **24**, a flow chart illustrating the creation of a shortcut is shown. Beginning in a start state **2400**, the preferred embodiment of the present invention proceeds to state **2402** where the user selects an on-line node and uses his mouse to drag and drop the selected node into his local file folder. While in state **2402**, the navigator **304** calls the DoDragDrop function **1214** in the shell folder object **1104** in response to the user's selection and dragging of the node with his mouse input device. The shell folder object **1104** asks the navigator **304** what the user has selected and the navigator **304** then sends the network identifier **214** for the selected node to the shell folder object **1104**.

For example, when the user selects the gardening bulletin board with his mouse and drags the gardening bulletin board to his local file system, the directory service navigator **304***b* calls the DoDragDrop function in the shell folder object **1104** associated with the gardening folder node **204***j*. The shell folder object **1104** then asks the navigator what the user has selected, and the navigator provides the shell folder object **1104** the network identifier of the gardening bulletin board **204***c*.

Proceeding to state **2404**, the shell folder object then executes the create node function **1208** as discussed above, to create a node pointer object **1108** for the selected node. In this example, the create node function **1208** creates the node pointer object **1108** and references the bulletin board navigator **304***c*.

Proceeding to state **2406** the shell folder object creates a shortcut data object for the selected node. The shortcut data object **2500** is illustrated in FIG. **25** and is compatible with the Object Linking and Embedding architecture. The shortcut data object **2500** contains the name **212**, the icon identifier **216**, the description **226**, the network path **1200**, the service group identifier **224** the service name **2502** and the service type **2504** of the selected node.

The name **212** includes the characters "shortcut to" and the name of the node. This name is the default format, but the user can alter the name **212** by selecting the shortcut data object **2500** and entering a new name. The icon identifier **216** identifies an icon bit map which represents the shortcut **2500**. The description **226** holds a description of the node referenced by the shortcut data object **2500**.

The network path **1200** contains the length header **1300**, network identifier **214** and validator **1302** for each node in the path to the selected node. In the preferred embodiment, the selected node is the last node in the network path **1200** and is followed by the null data segment **1304**. The service name **2502** is the name of the service associated with the selected node. In the preferred embodiment, the service name **2502** contains up to 32 characters. The service type **2504** describes the type of service associated with the selected node. For example, the service type **2504** could include "bulletin board," "folder," or chat.

In addition, the shortcut data object **2500** complies with data transfer formats known to one of ordinary skill in the art and the compound document files defined by the Object Linking and Embedding architecture as described in the in *OLE 2 Programmer's Reference Vol. I*, Microsoft Press, 1993, pp. 836–837 and in *OLE 2 Programmer's Reference Vol. II*, Microsoft Press, 1993, pp. 35 and Brockschmidt, *Inside OLE 2*, Microsoft Press, 1994, pp. 299–386.

While in state **2406**, the shell folder object creates the network path **1200** for the selected node. In addition, the shell folder object **1104** calls the GetProperty function **1228** in the referenced navigator **304** to get the name **212**, icon identifier **216** and description of the selected node. In this example, the network path **1200** contains the length header **1300**, network identifier **214** and validator **1302** for each node in the path to the garden bulletin board node **204***c*.

The shell folder object **1104** then stores the shortcut data object **2500** in the user's local file system. In the preferred embodiment, the shell folder object **1104** stores the shortcut data object **2500** with an *.mcc extension. In this example, the shell folder object **1104** stores the gardening bulletin board shortcut data object **2500** in the papers folder in the user's local file system with an *.mcc extension. The shell folder object **1104** the proceeds to a return state **2408** which returns the present invention back to state **1510** as illustrated in FIG. **15**. In state **1510**, the present invention waits for the next user command.

Because the shortcut data object **2500** complies with the format defined by the Object Linking and Embedding architecture, a user can transfer or electronically mail the shortcut data object **2500** to others. This greatly improves the ease of maneuvering within the on-line network. For example, if a user wants his friends to use the gardening bulletin board, the user can simply electronically mail the gardening bulletin board shortcut data object **2500** to his friends. The friends can immediately access the gardening bulletin board **204***c* by invoking the gardening bulletin board shortcut data object **2500**.

Thus, in this example, the user or his friends do not need to logon to the on-line network **100**, maneuver to the proper location and then invoke the gardening bulletin board service. Instead, when the user selects the gardening bulletin board shortcut data object **2500** located in his local computer, the present invention automatically logs onto the on-line network **100**, automatically maneuvers to the proper location and automatically launches the gardening bulletin board service.

When a user selects a shortcut data object **2500**, the operating system uses the *.mcc extension of the shortcut data object **2500** to identify and invoke a CCDIALER executable program. Referring now to FIG. **26**, a detailed flow chart of the CCDIALER program is shown. Beginning a start state **2600**, the CCDIALER program proceeds to state **2602** and invokes the computer shell object **1100**. Using the techniques described in state **1504**, the computer shell object **1100** creates a shell folder object **1104**. Proceeding to state **2606**, the shell folder object **1104** parses the network path **1200** and obtains the network identifiers **214** for the last node in the network path **1200**.

Proceeding to state **2608** the shell folder object calls the create node function **1208** as described in state **1506** above. The create node function **1208** then creates a node pointer object for the last node in the network path **1200**. Proceeding to state **2610**, the shell folder object uses the techniques described above in state **1510** to see if the last node in the network path **1200** is a folder node **204** or a leaf node **206**.

If the last node in the network path **1200** is a folder node, the shell folder object calls the GetViewWndObject function **1226** in the referenced navigator **304**, as described above, to display the contents of the folder node **204**. Thus, if the shortcut data object **2500** contains a network path **1200** to a folder node **204**, the present invention, automatically logs on to the on-line network **100**, locates the desired folder node **204** in the on-line network **100** and displays the contents of the desired folder node **204** with the assigned navigator **304**.

If, on the other hand, the last node in the network path **1200** is a leaf node, the shell folder object calls the Execute function **1232** as described in state **1512**. The execute function **1512** and the shell folder object **1104** then locate and invoke the desired client application associated with the leaf node **206**. For example, if the last node in the network path of the shortcut data object contains a chat leaf node **206**. Thus, if the shortcut data object **2500** contains a network path **1200** to a leaf node **206**, the present invention accesses the on-line network **100**, locates the desired leaf node **206**, spawns a new process and executes the chat client application which corresponds to chat leaf node **206**.

While the above detailed description has shown, described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the illustrated device may be made by those skilled in the art without departing from the spirit of the invention. Consequently, the scope of the invention should not be limited to the foregoing discussion but should be defined by the appended claims.

What is claimed is:

1. An access system for presenting the content of an interactive on-line network to a user, comprising:

a plurality of navigator modules stored in an end-user station, said navigator modules adapted to communicate with an on-line network, each of said navigator modules configured to display a different user interface corresponding to different offerings on said on-line network;

a network shell module stored in said end-user station, said network shell module in communication with said plurality of navigator modules, said network shell module having a plurality of network identifiers corresponding respectively to said plurality of navigator modules, each of said network identifiers further corresponding to a different offering in said on-line network, whereby said network shell module responds to each of said network identifiers to direct said identified navigator module to display said user interface; and

a computer shell module stored in an end-user station, said computer shell module part of an operating system of said end-user station and in communication with said network shell module and said plurality of navigator modules, said computer shell module adapted to display a local file system user interface, wherein said computer shell module, said network shell module and said plurality of navigator modules interact to display said local file system user interface and said user interfaces corresponding to said offerings.

2. The access system of claim **1**, wherein said plurality of navigator modules are capable of accessing a plurality of data sources.

3. The access system of claim **1**, wherein said plurality of navigator modules contain a plurality of navigation functions, said navigation functions implementing said user interfaces.

4. The access system of claim **1**, wherein the names of said navigation functions are standardized such that each of said navigator modules are identified with common navigation function names.

5. The access system of claim **1**, wherein said offerings are represented as nodes in said on-line network.

6. The access system of claim **1**, wherein said network shell module further comprises a navigation table wherein said navigation table associates each of said network identifiers with one of said navigator modules.

7. The access system of claim **6**, wherein said network identifier further comprises an application identifier and a nodal identifier and wherein said navigation table associates each of said application identifiers with one of said navigator modules.

8. The access system of claim **1** further comprising a shortcut data structure stored in an end-user station, said shortcut data structure configured to store a network path which identifies the location of each of said offerings in said on-line network.

9. The access system of claim **8** wherein said network shell module locates said offering identified by said network path.

10. The access system of claim **1** wherein said network shell module is further configured to display a content map which displays the hierarchy of said offerings in said on-line network.

11. The access system of claim **1**, wherein one of the said offerings is a news service, a weather service, a bulletin board service, an electronic mail service, a chat service, a media view service, or an interactive game service.

12. The access system of claim **8**, wherein the shortcut data structure is a shortcut data object.

13. The access system of claim **8**, wherein the shortcut data structure is an Object Linking and Embedding (OLE) object.

14. An access system for presenting the content of an interactive on-line network to a user, comprising:

a network shell module stored in an end-user station, said network shell module adapted to access a plurality of

offerings in an on-line network, each of said offerings having an associated set of properties; and

a network cache stored in said end-user station, said network cache in communication with said network shell module, said network cache configured to store a copy of said set of properties associated with each of said offerings accessed by said network shell module, whereby said network shell module retrieves said copy of said set of properties from said network cache when accessing one of said offerings a second time.

15. The access system of claim **14** wherein said network cache only exists during a logon session.

16. The access system of claim **14** wherein each of said set of properties are stored in a nodal data structure in said end-user station.

17. The access system of claim **14** wherein each of said set of properties contains a node name, network identifier, icon identifier and description.

18. The access system of claim **17** wherein said network cache stores a copy of each of said nodal data structures and whereby said network shell module retrieves said copy of said nodal data structure from said network cache when accessing one of said offerings a second time.

19. The access system of claim **18** further comprising a plurality of navigator modules stored in an end-user station, said navigator modules adapted to communicate with said on-line network and said network shell module, each of said navigators adapted to display a different user interface.

20. The access system of claim **19** wherein each of said nodal data structures are configured to reference one of said navigators.

21. A machine for presenting a content map which illustrates the organization of information in an interactive on-line network, comprising:

an on-line network containing a plurality of offerings, each of said offerings linked together to form a hierarchical data structure;

a computer shell module stored in an end-user station, said computer shell module part of said end-user station's operating system, said computer shell module adapted to display said end-user station's file system; and

a network shell module stored in an end-user station, said network shell module in communication with said computer shell module and said on-line network, said network shell module adapted to access said offerings in said on-line network, said network shell module further adapted to interact with said computer shell module to display a content map, said content map illustrating the organization of said end-computer's file system and the organization of said offerings in said on-line network.

22. The machine of claim **21**, wherein each of said offerings has an associated network identifier and wherein said network shell module combines said network identifiers into a network path which identifies the location of one of said offerings in said on-line network.

23. The machine of claim **22**, wherein a plurality of network paths identify a plurality of locations in said on-line network and wherein said computer shell uses said plurality of network paths to create said content map.

24. The machine of claim **21**, wherein said offerings are nodes in said on-line network which are linked together to form an acyclic graph.

25. The machine of claim **21**, wherein said on-line network further comprises:

a plurality of application servers interconnected by a local area network, each application server running at least one service application which implements an on-line service, different groups of said application servers running different service applications to provide different on-line services; and

a plurality of gateway computers connected to said application servers by said local area network and connected to said end-user station via a wide area network, each gateway computer programmed to receive service requests from said end-user station and to route said service requests to application servers running corresponding service applications.

26. The machine of claim **25**, wherein said network shell module is further adapted to access said service applications to obtain information about said offerings in said service applications.

27. An object-oriented access system for presenting the content of an interactive on-line network to a user, comprising:

a computer shell object stored in an end-user station, said computer shell object part of said end-user station's operating system, said computer shell object adapted to display a user interface;

a plurality of network shell objects stored in said end-user station, said network shell objects in communication with said computer shell object, each of said network shell objects corresponding to at least one of a plurality of nodes in an on-line network;

a plurality of node objects, said node objects stored in said end-user station, said node objects in communication with said network shell objects and said computer shell object, each of said node objects adapted to reference at least one of said plurality of nodes in said on-line network; and

a plurality of navigator modules in communication with said node objects, each of said navigator modules configured to display a different user interface, wherein each of said node objects reference one of said navigator modules.

28. The object-oriented access system of claim **27** wherein each of said plurality of network shell objects includes elements for creating said node objects.

29. The object-oriented access system of claim **28** wherein each of said plurality of network shell objects includes the network path to one of said nodes in said on-line network.

30. The object-oriented access system of claim **29** wherein each of said plurality of network shell objects includes elements configured to format a plurality of said network paths and communicate said network paths to said computer shell object whereby said computer shell object displays a content map of said on-line network.

31. An access system for presenting the content of an interactive on-line network to a user, comprising:

a computer shell means for displaying a user interface, said computer shell means part of said end-user station's operating system;

a plurality of navigator means for communicating with an on-line network, each of said navigator means configured to display a different user interface corresponding to different offerings on said on-line network; and

a network shell means for storing a plurality of identifiers corresponding respectively to one of said navigation means, said network shell means in communication with said computer shell module and said plurality of navigator means, whereby said network shell means responds to each of said identifiers to direct said identified navigator means to display said user interface.

32. The access system of claim 31 further comprising a network cache means for storing a copy of a set of properties associated with each of said offerings in said on-line network accessed by said network shell module.

33. The access system of claim 32 further comprising a shortcut means for directly accessing one of said offerings in said on-line network, said shortcut means containing a network path to one of said offerings, said shortcut means adapted for storage in said end-user station.

34. An access system for presenting the content of an interactive on-line network to a user, comprising:

a plurality of navigator modules stored in an end-user station, said navigator modules adapted to communicate with an on-line network, each of said navigator modules configured to display a different user interface corresponding to different offerings on said on-line network;

a network shell module stored in said end-user station, said network shell module in communication with said plurality of navigator modules, said network shell module having a plurality of network identifiers corresponding respectively to said plurality of navigator modules, each of said network identifiers further corresponding to a different offering in said on-line network, whereby said network shell module responds to each of said network identifiers to direct said identified navigator module to display said user interface; and

a shortcut object stored in an end-user station, said shortcut object including a shortcut data structure configured to store a network path which identifies the location of each of said offerings in said on-line network.

35. The access system of claim 34 wherein said network shell module locates said offering identified by said network path.

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